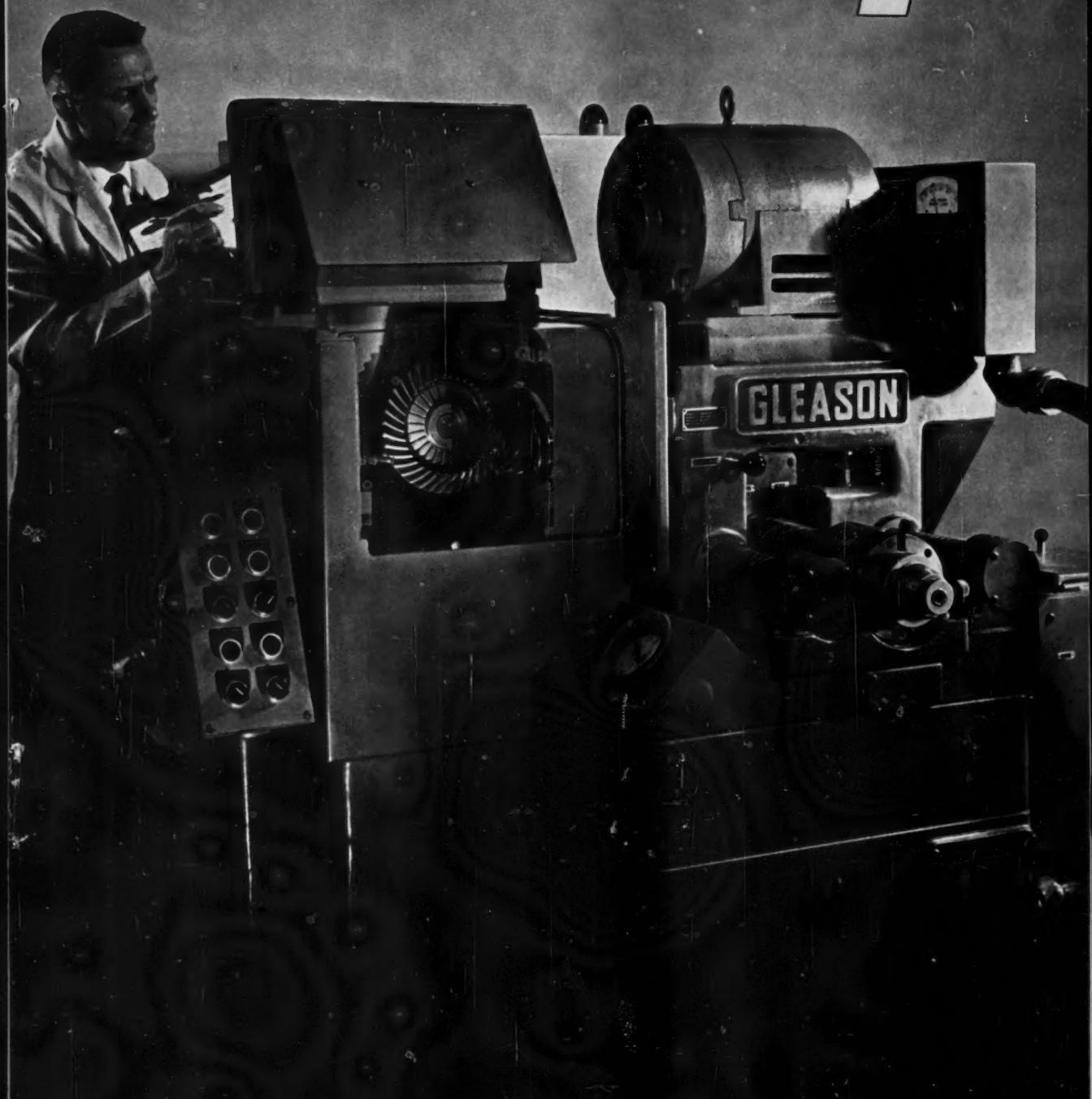


ENGINEERING AND PRODUCTION IN METALWORKING

SEPTEMBER, 1961

Machinery



NEW NO. 503 GLEASON HYPOID LAPPER FEATURES NEW SPC LAPPING MOTION

See Advertisement Page 51



NUMERICALLY CONTROLLED DRILLING...

A short cut to a fast payoff

by Gordon Deagle

*Engineer, Bore-Matic Division
The Heald Machine Company*

Drilling has long been one of the simplest and most universally used operations in the machine tool field. Furthermore, of the various numerically controlled machines, the *drill* is one of the quickest to return its cost through resultant savings.

This is due largely to the fact that the increased accuracy required in most of today's drilling operations has heretofore been met by building expensive jigs and fixtures. And often these special fixtures have been made obsolete due to design changes long before they have repaid their cost through savings.

Many people think of numerical control only in terms of very high production. But with drilling this is not the case at all.

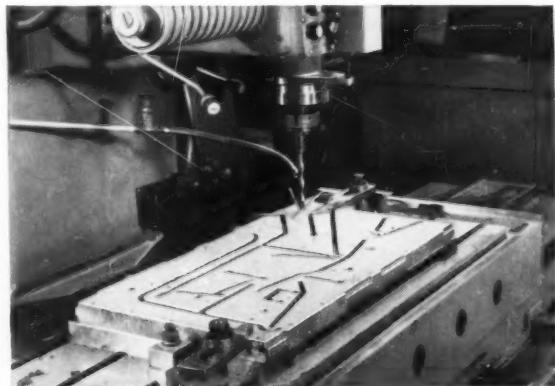
The HEALDRILL, a high-precision automatic tape-controlled drilling machine, has been profitably applied on many short run jobs involving frequent changeovers. In fact operating experience in our own drill department proves that the cost savings are even greater where small lots of many different parts are involved than on high production jobs where the expense of special jigs and fixtures might be recovered before obsolescence.

A case in point is the Heald hydraulic valve plate illustrated here in a setup on the machine. A mating pair of these plates forms a multi-channel valve panel which requires 54 drilled holes, 44 drilled and counterbored holes, and 75 holes that are drilled, reamed and tapped. All of these operations are now done on the numerically-controlled HEALDRILL and all cycle functions are fully auto-

matic except for tool changes. Based on manufacturing in lots of 10, with a total of 200 before obsolescence of the part, the HEALDRILL method has saved \$39.90 per panel over the jig method. This is a total saving of \$7,980.00 on one job alone—almost 20% of the entire cost of the machine!

Hole positioning, feeds, speeds, rapid traverse and full depth limits, and drilling or tapping cycle are selected by the tape and hence are completely independent of the operator's skill, accuracy or speed. Tool changes, when required, are indicated by the machine and can be made in a matter of seconds. And total floor-to-floor time can be reduced by as much as 50 per cent. Changeover to another job requires no setup time except that required to insert a new tape in the control unit and locate the part on the table.

Preparation of the control tape for a new part is fast and relatively simple. With a HEALDRILL, sample and pilot lot production can be accomplished in days instead of weeks, and at minimum cost.



Hydraulic valve panels with 173 holes are precision drilled, counterbored and tapped on the HEALDRILL, at a saving of \$39.90 per panel.

For complete information on the numerically-controlled HEALDRILL contact your Heald engineer—or send for a copy of Bulletin 2-20-48.

It Pays to come to Heald

THE **HEALD** MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts



HEALDRILL in operation in drill department of The Heald Machine Company in Worcester, producing precision drilled, bored, counterbored, reamed and tapped parts for other Heald machines.

SEPTEMBER 1961

VOL. 68 No. 1

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Machinery

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION
IN THE MANUFACTURE OF METAL PRODUCTS

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what's a
BROAD
product line?

When speaking of threading machines and tools *this* is a broad product line — as manufactured by LANDIS Machine COMPANY.

■ THREAD ROLLING ATTACHMENTS ■
THREAD ROLLING MACHINES ■ THREAD
ROLLING HEADS / THREAD CUTTING DIE
HEADS ■ THREAD CUTTING MACHINES ■
COLLAPSIBLE TAPS — STRAIGHT & TAPER
■ SOLID ADJUSTABLE TAPS ■ NIPPLE
THREADING MACHINES ■ PIPE THREAD-
ING AND CUTTING MACHINES ■ COU-
PLING TAPPING MACHINES ■ CENTER-
LESS THREAD GRINDERS ■ ROLLER PIPE
CUTTERS ■ CHASER GRINDERS ■ THREAD
CUTTING CHASERS & THREAD ROLL DIES

Machines and Tools for producing all types of threads by CUTTING, ROLLING, TAPPING, and GRINDING are manufactured by LANDIS Machine COMPANY. Save time, save money by buying from us. Our over 55 years of experience in the threading field has resulted in the most complete line of threading equipment IN THE WORLD! For more information ask for the Landis Condensed General Catalog.

LANDIS Machine COMPANY
WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

622C

NOW...A Larger Capacity FELLOWS-PFAUTER High-Speed Hobbing Machine...The P 630

You get all the advanced-design features of the production-proved P 400 Fellows-Pfauter hobbing machine — plus extra work capacity — with the new Model P 630. Takes work up to a diameter of 25". Maximum face width at 25" diameter is 16 $\frac{1}{4}$ ". Maximum diametral pitch in steel is 3. It's fast, easy-to-handle . . . and it's built for high production.

For example: Work area is readily accessible for setup and loading. Table retracts automatically from hob to facilitate work changes. Hob shifting is controlled by pushbutton. And built-in hydraulics assure smooth operation of tailstock and fixtures.

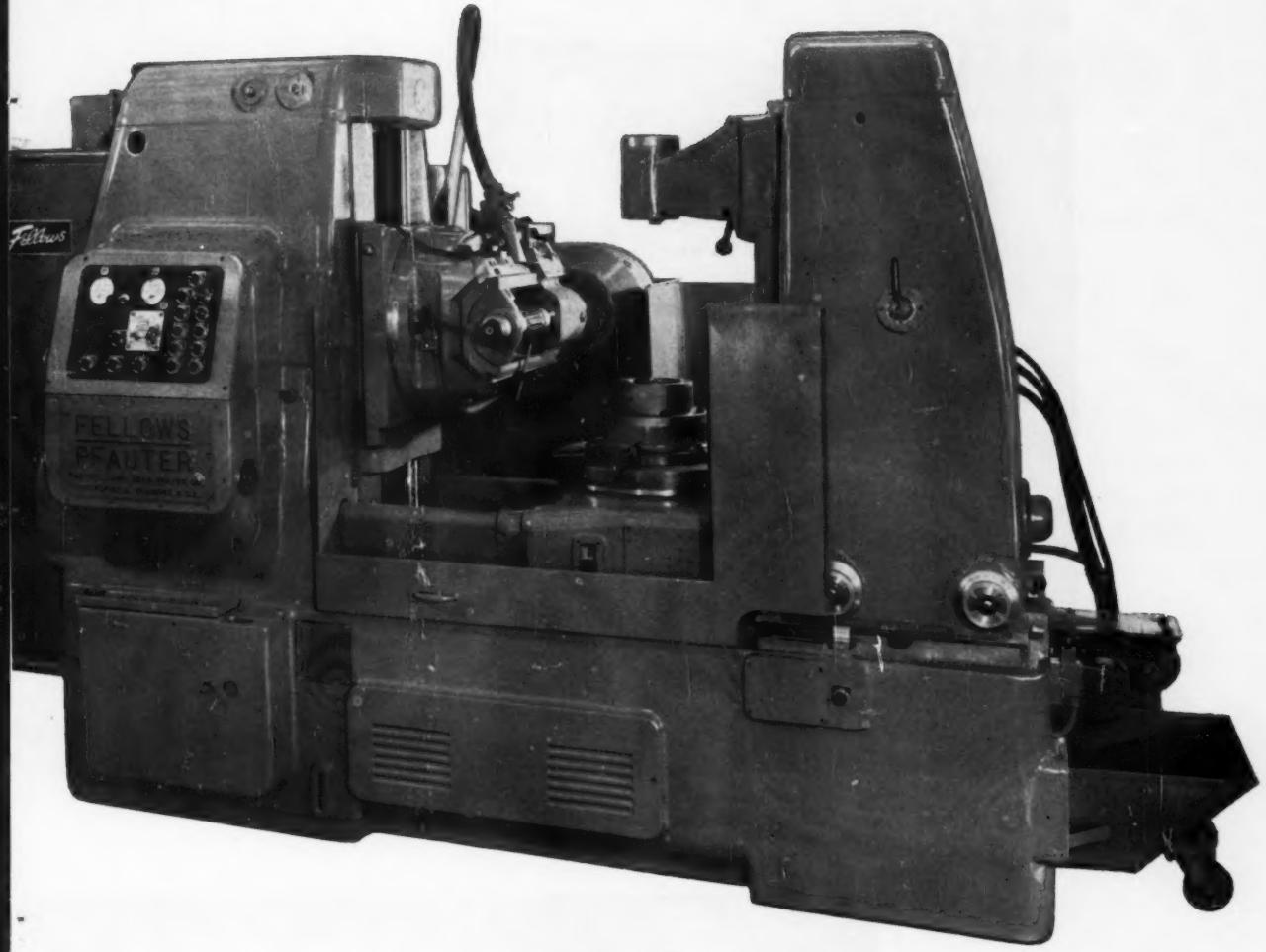
Solid construction features include: rugged hob head and double wall construction column and bed, with heavy V-ways. Table is as large as maximum workpiece diameter, and index worm gear nearly as large as work table. Work column is of massive design.

Reduce your production costs with this new Fellows-Pfauter. Get complete details now.



NEW... Dictionary of Change-Gear Combinations

Eliminate tedious calculations and trial-and-error methods for finding change gear combinations. Now, simply look them up like words in a dictionary in "Fellows-Pfauter Change Gear Tables" by F. Becher and A. Koerner. This English edition contains combinations for more than 26,000 ratios carried to six decimal places from .100,000 to 1,000,000, with the greatest step approximately .00005. Change gears in the range of 18 to 80 teeth are mainly used. Examples of applications are given. Only \$8.00. Get a copy now. Send your order to THE FELLOWS GEAR SHAPER COMPANY, 78 River Street, Springfield, Vermont, U. S. A.



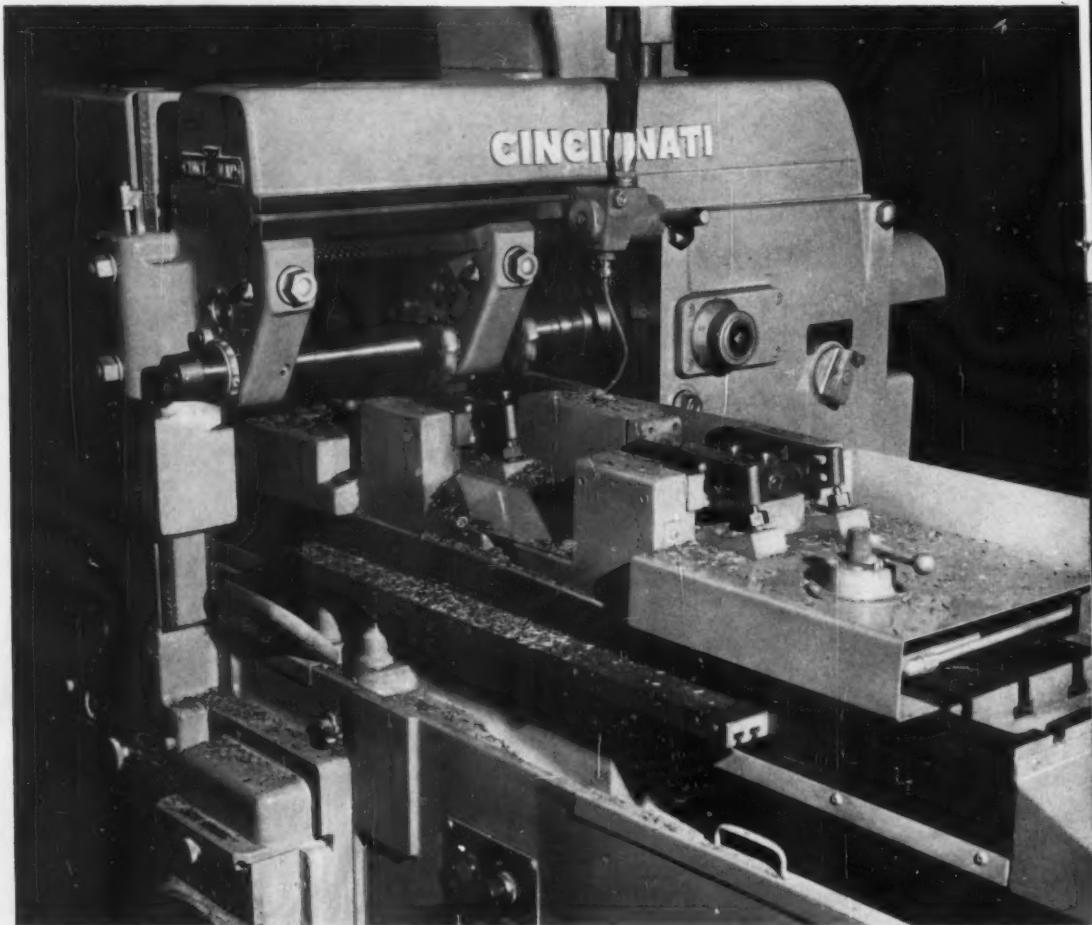
THE FELLOWS GEAR SHAPER COMPANY
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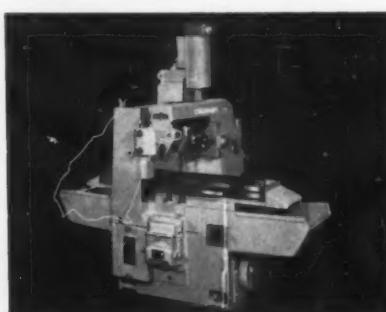
THE
PRECISION
LINE

Fellows

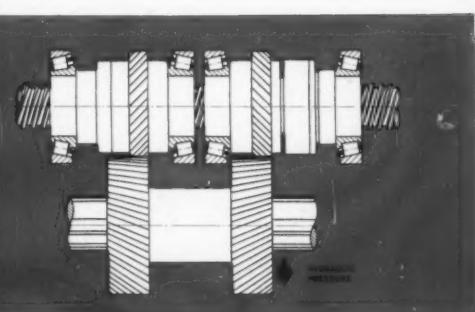
Gear Production Equipment



Shotgun frames are automatically profile milled, at a down-milling feed rate of 9-9/16 in./min., two abreast (four per cycle) on this new CINCINNATI Powermatic Rise-and-Fall Milling Machine.



CINCINNATI Powermatic Rise-and-Fall Milling Machine. 24" or 30" table travel; 7½ hp spindle drive. Catalog No. M-2167.



Automatic compensation for wear between table feed screw and nut; a prime feature-advantage for reciprocal setups and "down" milling.

KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES • CUTTER AND TOOL GRINDERS •
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO



FOUR in ONE

TIMESAVING POWERMATIC CYCLE ...

Four Parts Profile Milled Two Abreast

New CINCINNATI Powermatics give automatic cycle milling a new dimension in cost reduction. The example at the left shows one of the many unique possibilities. In a single timesaving cycle, bottom profiles are milled on four shotgun frames. They are mounted two abreast, in a Cincinnati designed, hydraulically operated fixture. Smooth down-milling, an advantage derived from Powermatic's automatic backlash eliminator, produces a superior finish and prevents springing of the work.

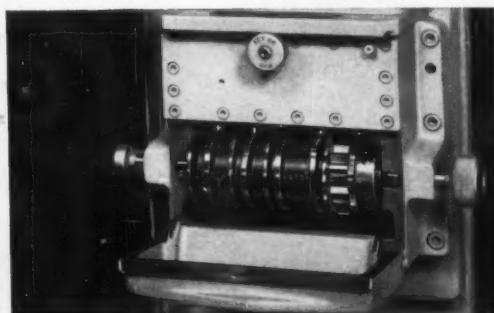
In addition to dozens of automatic cycles and the positive action automatic backlash eliminator, other Powermatic feature-advantages include:

- Table feeds and spindle speeds easily

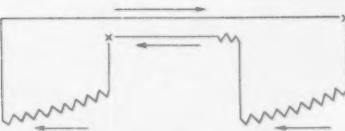
changed . . . simple pick-off gears; no wrenches required.

- Single lever control . . . starts the complete automatic cycle.
- Effective chip and cutting fluid collecting system . . . chip pans easily removed.
- Dynapoise overarm . . . damps chatter, allowing highest feed rates to be used.
- One integral casting for the front base and column . . . assures maximum rigidity for full hp cuts.

Many additional feature-advantages give new CINCINNATI Powermatics the highest cost-reducing potential for medium-duty work, in high-volume and medium-volume shops. Get more information by asking for a copy of Catalog M-2167.



Program director . . . a simple cycle selector controls sequence of events in automatic cycle. Can be interchanged in a minute or less.



A two-segment automatic cycle, one of dozens available on the new CINCINNATI Powermatic Rise-and-Fall Milling Machine, is employed to profile mill four parts, two abreast.

VERTICAL BROACHING MACHINES • ELECTRICAL MACHINING EQUIPMENT

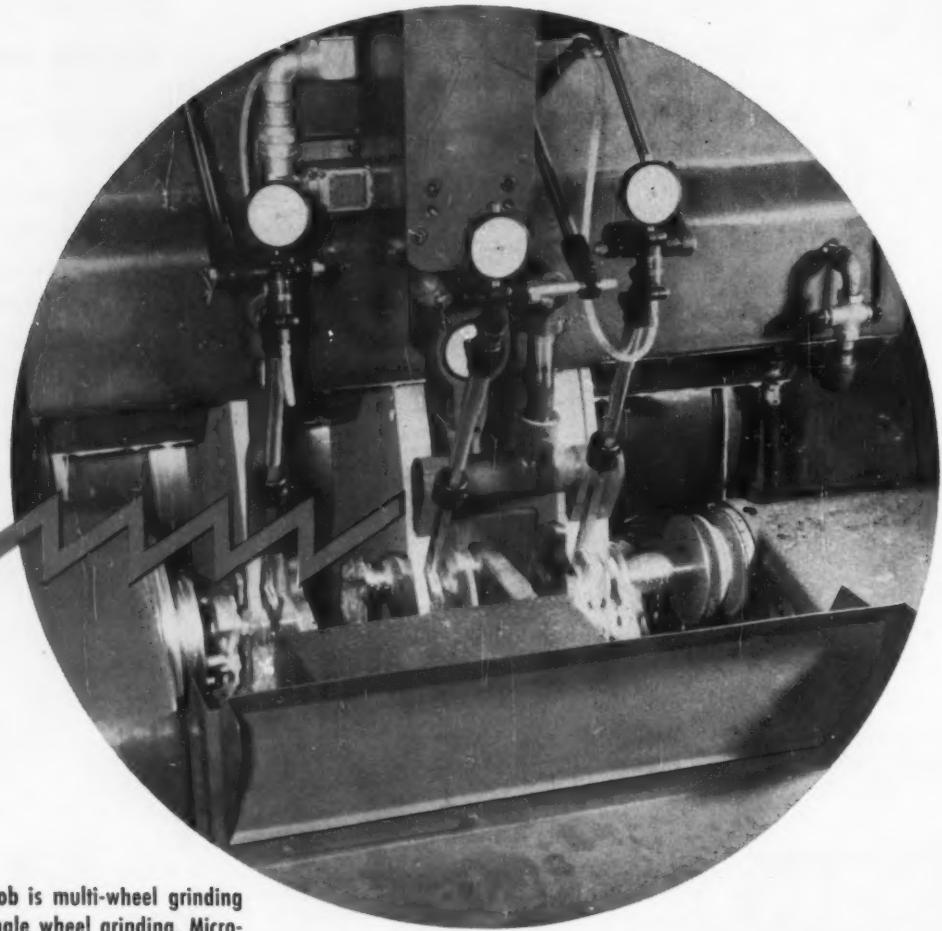


Automatic Race grinder

10" R Plain grinder

14" IWR Multiple Wheel grinder

Landis production grinders with Microfeed®



Whether your job is multi-wheel grinding like this, or single wheel grinding, Microfeed will assure quality and reliability.

typical Microfeed applications



tapered bearing race
specified size tolerance: .0002"



multiple diameter shaft
specified size tolerances: .0001"



Automatic Plunge grinder



Automatic Crankpin grinder

deliver closer tolerances consistently

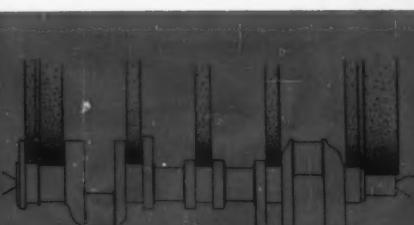
Microfeed



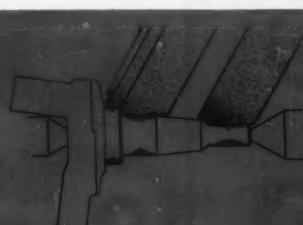
- a new Landis precision wheelfeed that is a major breakthrough in size control
- specified on new Landis grinders, Microfeed assures cylindrical grinding precision to your specified tolerances on a production basis
- automatically cancels all variables affecting work size

LANDIS

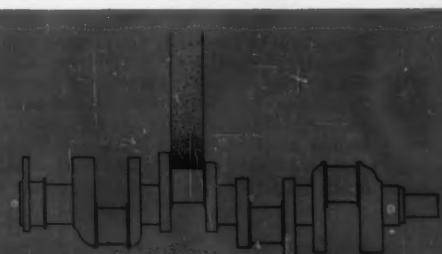
LANDIS TOOL COMPANY, WAYNESBORO, PA.



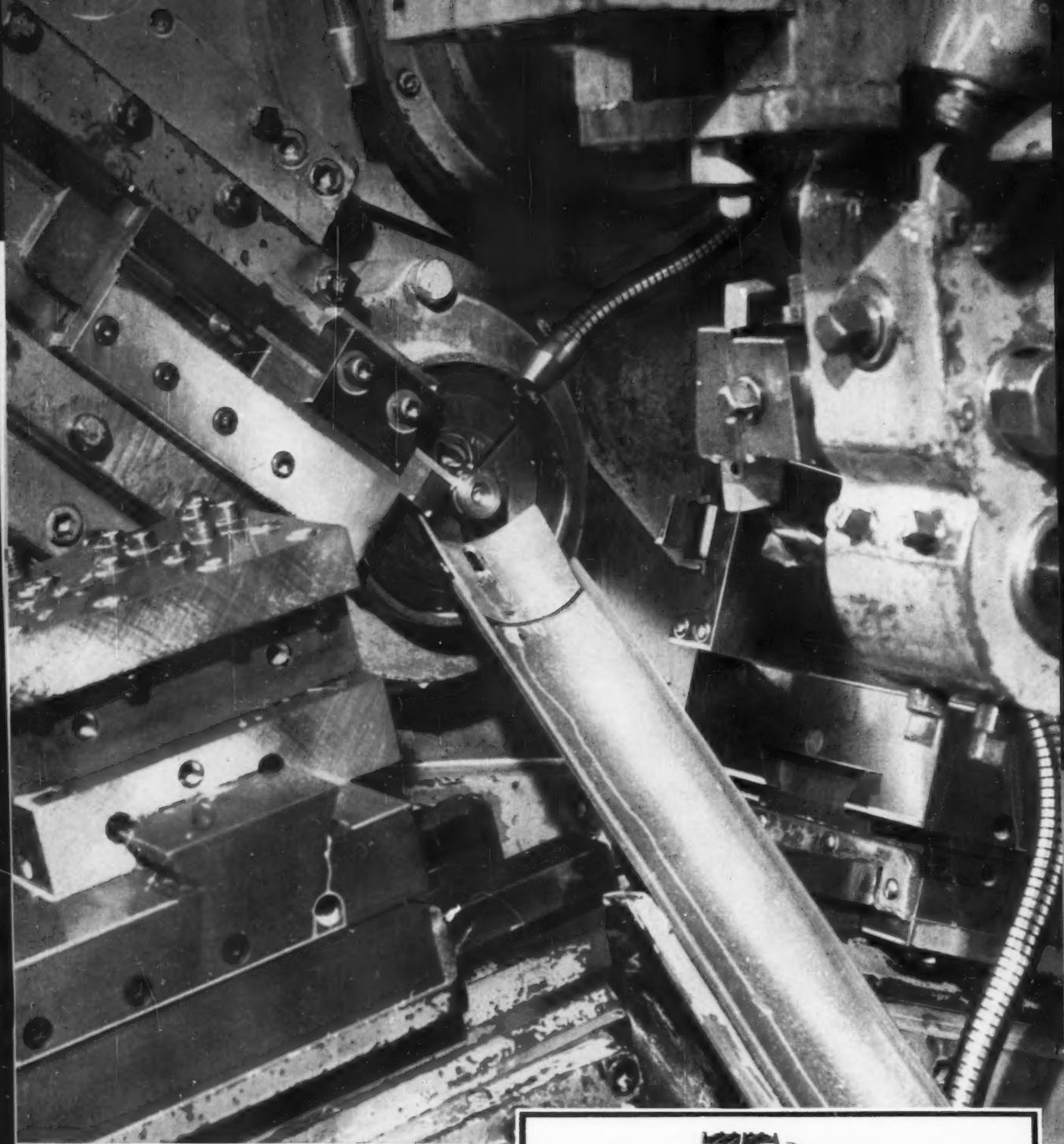
crankshaft line bearings
specified size tolerances: .0005"



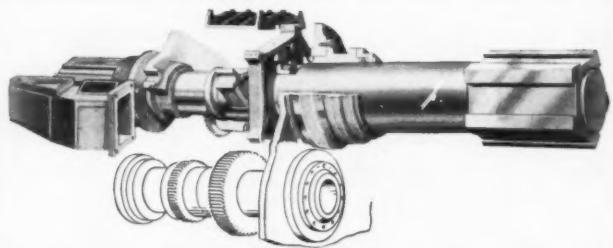
steering knuckle
specified size tolerance: .0006"



crankshaft pins
specified size tolerances: .0005"

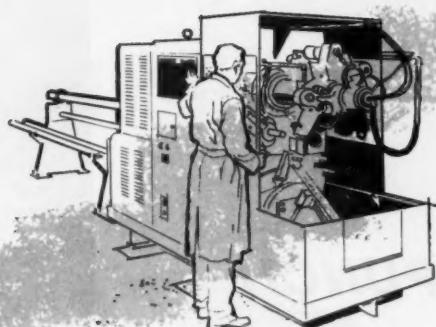


The secret of precision finishing on automatics lies strongly in customer "know-how". Good machine design also helps. For example, the massive 2AB Pentagon Turret is located overhead, away from accuracy-destroying grit, and coolant splash. For lasting accuracy, turret and spindle bearings are ruggedly built and housed within the same temperature zone to insure stability under operation.



AT ARCH GEAR WORKS, INC.

Quincy, Mass.



3" Bar Automatic produces stainless gears with .0005" tolerances and 16 rms finishes

Contract shop stays highly competitive with elimination of extra finishing operations, low tool costs, 3 to 4-hour setups.

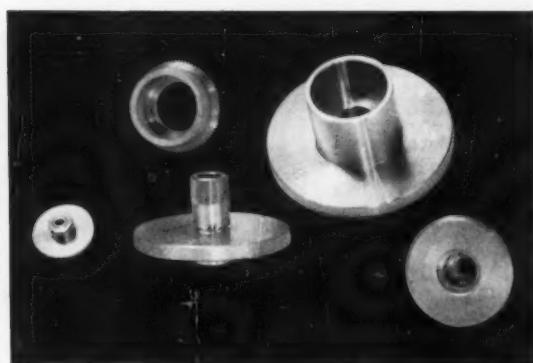
By using a Warner & Swasey 2AB Single Spindle Bar Automatic for small lot precision gear work, Arch Gear Works has eliminated

secondary finishing operations.

Tooling costs are at rock-bottom, with the 2AB utilizing simple cutter bits in its multiple-position tool stations. The cost of cams is eliminated by controlling feeds, speeds, turret strokes and other motions with easy-to-set trip dogs.

Since they can set up their 2AB in 3 to 4 hours, Arch Gear Works is automating lots as low as 150 pieces—jobs formerly considered profitable only on hand-operated machines.

No wonder this New England concern bids successfully on jobs it may never see again. If you are bidding high on similar work, why not get the facts on the 2AB? Call your local Warner & Swasey Office, or write Warner & Swasey Company, Cleveland 3, Ohio.



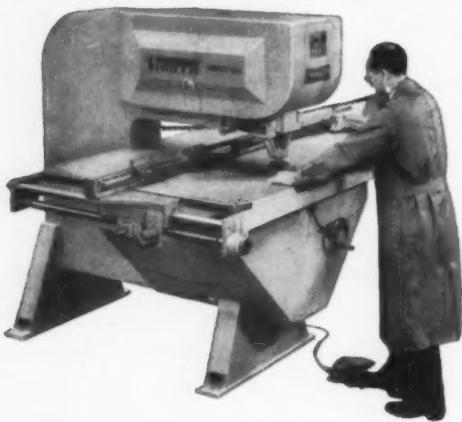
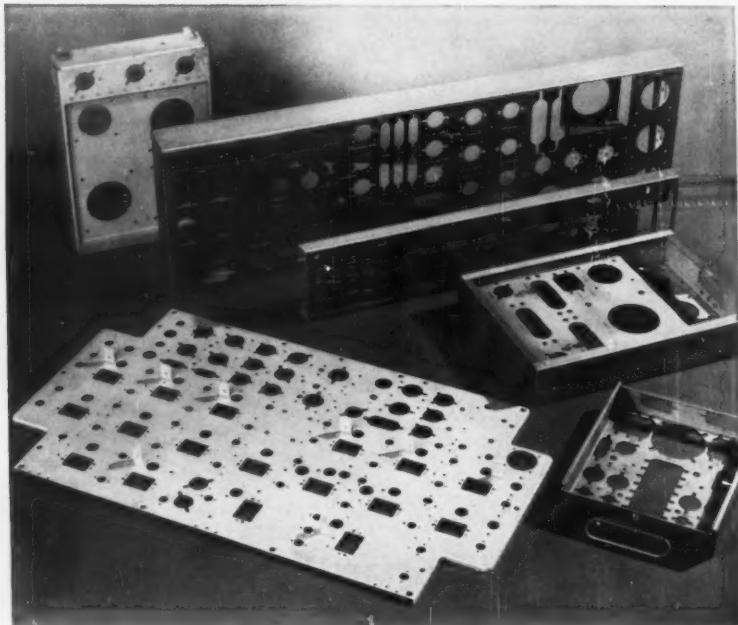
75% of Arch Gear's precision parts are stainless steel. The 2AB produces jobs like these 3 times faster than turret lathes, and eliminates the extra finishing operations as a bonus.

**YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY**



For more data, circle this page number on Readers' Service Card.

**PUNCH
COMPLICATED
PATTERNS
FAST WITH STRIPPIT FABRICATORS**



SUPER 30. Handles flat or formed workpieces 60" wide...any length. Both the Super 30 and the 15A punch round and shaped holes up to 3½" diameter, to ¼" thick material...notch 90° corners—rectangular, radii, vee and special shape edge notches—up to ½" capacity...nibble straight line or contour shear up to 38" diameter circle, at 165 strokes a minute in ½" material.

STRIPPIT DUPLICATOR

For low cost production runs on the Super 30 or 15A, the STRIPPIT Duplicator functions like a pantograph to reproduce any hole pattern from a drilled or punched template. No custom dies needed to turn out precision sheet metal parts.



NEW 15A. Designed for workpieces up to 30" wide...any length...the new 15A Fabricator offers all the speed and accuracy of the Super 30. Each machine, with its own universal tool holder, makes it possible to interchange standard and special tools in seconds to minimize down-time. Flat punched parts produced require no deburring. Multi-stop micrometric gaging system positions work rapidly to exact layout specifications.

WALES **STRIPPIT** INC.
203 Buell Road • Akron, New York



In Canada: Strippit Tool & Machine Company, Brampton, Ont.; In Continental Europe: Raskin, S. A., Lausanne, Switzerland; In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England.

4,245,302 BEARING ROLLERS GROUND ON ONE PAIR OF DISCS



more parts per disc

production data

part roller bearing .328" x .570"
machine . . Gardner 2H20 Double Spindle
Precision Disc Grinder
production 9,350 parts per hour
stock removal017"-.020"
flatness0002"
parallelism0002" or less
uniformity0005"
squareness0002" or less
finish10-15 RMS

Check with your Gardner Abrasive Specialist to see how performance like this can lower your disc grinding costs.

lower unit costs

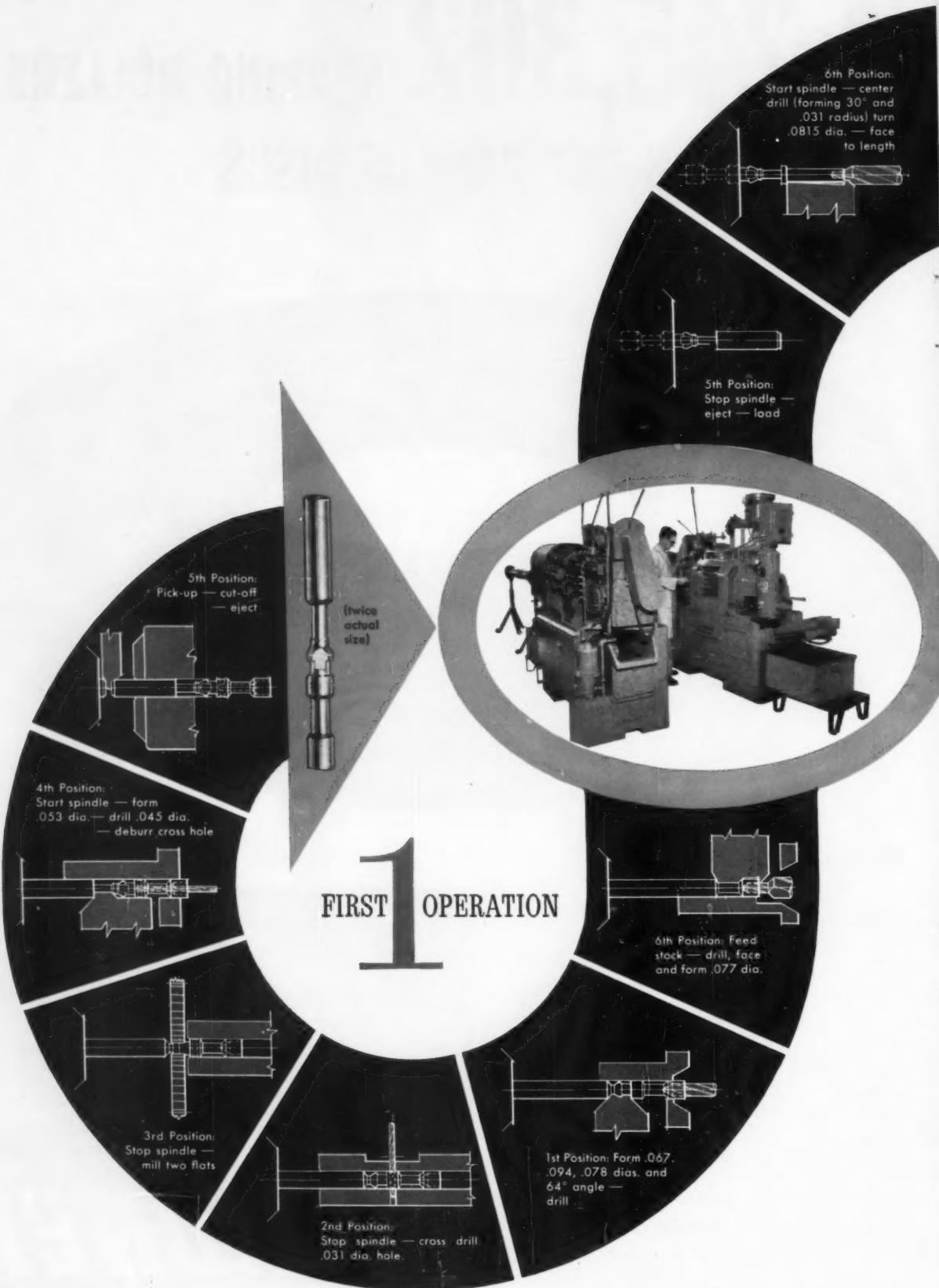


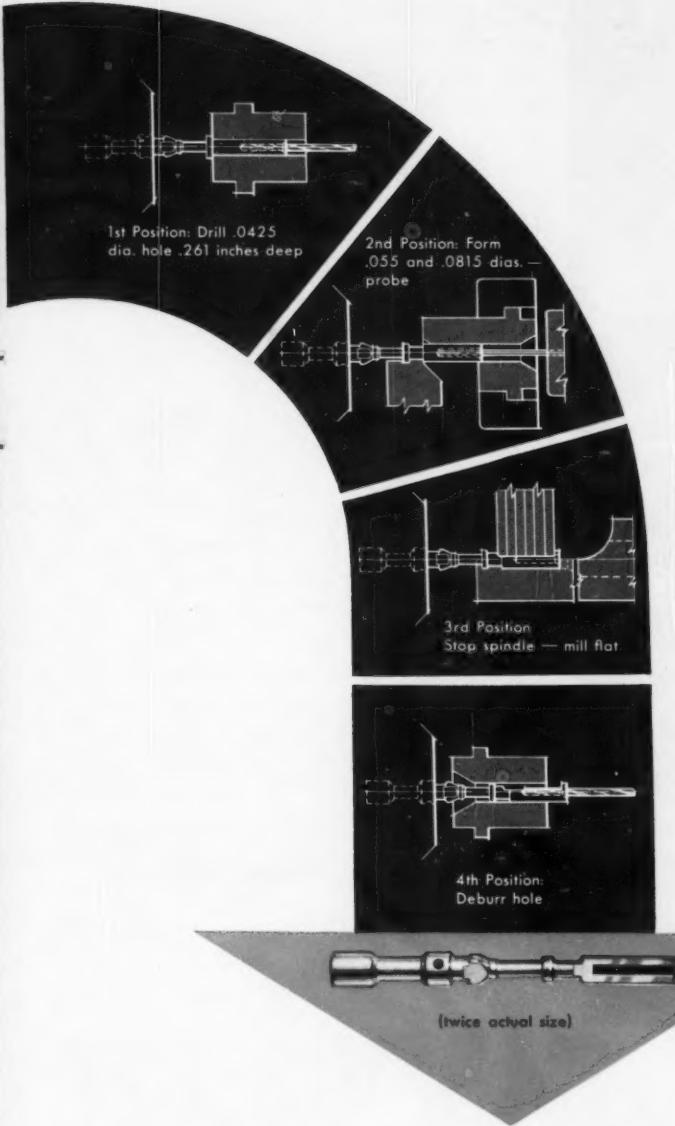
these roller bearings ground
on one pair of Gardner discs

GARDNER

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

1 FIRST OPERATION





SECOND 2 OPERATION

ACME-GRIDLEYS REDUCE MACHINE TIME 80% OPERATOR TIME 70%

*...FOR SCINTILLA DIVISION
OF THE BENDIX CORPORATION*

When it comes to economically turning out large quantities of identical precision parts, most cost-conscious manufacturers rely on Acme-Gridleys. A good example is one of the nation's leading suppliers of electrical connectors to space age industries, Scintilla Division of The Bendix Corporation, Sidney, New York.

Recently, Scintilla converted production of an electrical contact socket and connector to $\frac{7}{16}$ " RA-6 Spindle Acme-Gridleys. Working to tolerances of .002 on turned diameters, .005 on concentricities and 50 microinches or better on drilled holes, the Acme-Gridleys reduced per-piece machine time 80% and operator time 70%! There was also a significant reduction in the reject rate.

Savings like this are the big reason Scintilla has close to seventy Acme-Gridleys in their modern production setup. In your plant, Acme-Gridleys will pay off in similar cost reductions... for years to come.

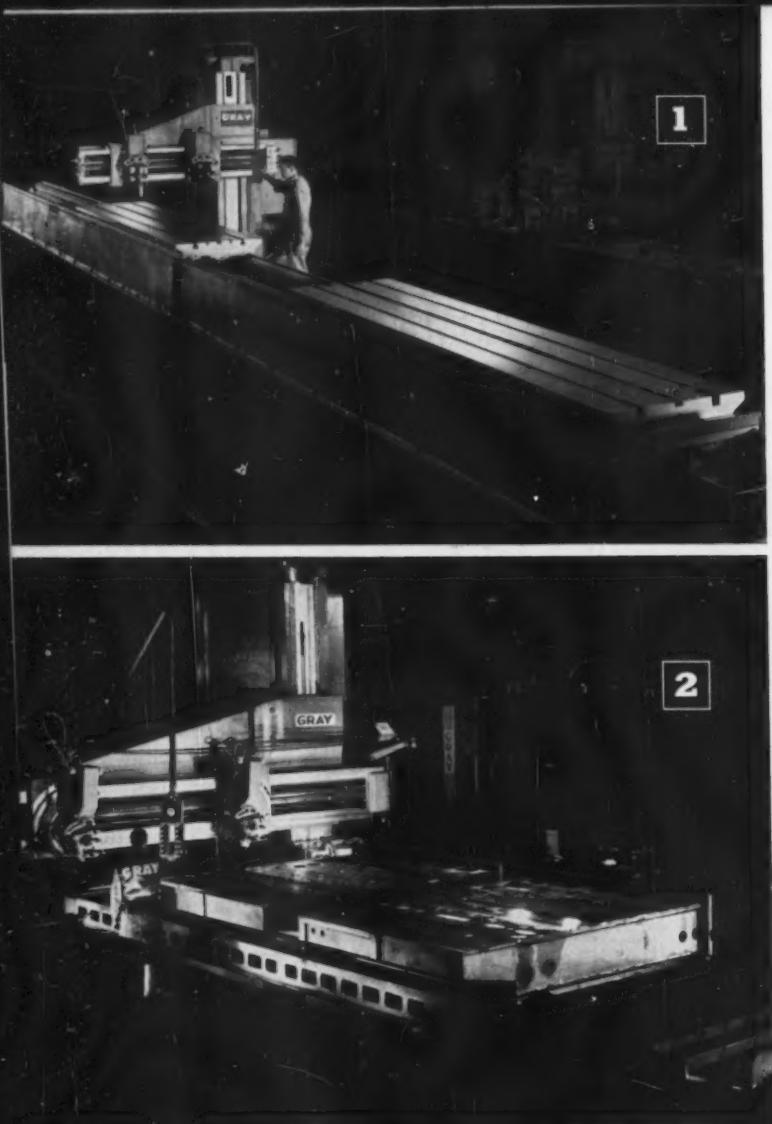
The number of different jobs that can be set up on Acme-Gridleys amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64-page bulletin called "Circumferential Automation at Work". At your request, we'll be happy to send you a copy. Call, write or wire.



National Acme

The National
Acme Company
179 E. 131st Street
Cleveland 9, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

**1**

These GRAY machines feature simplified operation, rugged dependability and great precision. Their high speed, power packed performance removes metal faster and more economically. They pay for themselves by increasing your production, lowering operating costs, reducing downtime.

1. Gray flying scot planer. Most economical universal high speed planer ever built • Size 30" x 6' • Table speed range 30-300 F.P.M. • Model shown is 42" x 28' with duplex table.

2. Gray universal planer. Size 48" x 14' • Cuts both ways, out performs a milling machine on flat surfaces with less tool cost.

3. Gray planer type milling machine. Size 48" x 48" x 16' • Has 10" quill, 50 H.P. non-swiveling rail head • Width between housing 61" • Phase I Space-setter visually shows where you are.

4. Gray horizontal boring, drilling, milling machine. Has 6" dia. nitr alloy bar, 60" bar travel • 72" vertical head travel • 50 H.P. spindle motor • Phase III Space-setter, point to point positioning on two rails, runaway and column.

Specific bulletins available on all machines on request from
THE G. A. GRAY CO. / CINCINNATI 7 / OHIO

GRAY

**3**

consistently purchased

4



by companies who know **QUALITY** doesn't cost

it pays!



Here's a Team of Mills that Really Pay their Way

When you can use South Bend Milling Machines for tool and die work and fill in free time with production runs, you've got an ideal situation. Here Metal Processors are drawing upon the two main capabilities of these machines—accuracy for exacting work and productivity for manufacturing operations.

"Double lives" are not unusual for South Bend Mills as they are readily adaptable to wide varieties of work with a minimum of effort and no sacrifice in accuracy because

of such features as these:

- Head rotates 360° vertically . . . mills, bores, drills and reams at any angle
- Keyed ram saves re-setting, holds alignment
- 30 table feeds; infinitely variable quill feeds
- 32" or 42" tables, 20" or 30" table travel, 20" spindle to table, 20" spindle to column

Prices start at \$1829 less power feeds.

WRITE FOR COMPLETE INFORMATION

SOUTH BEND LATHE

SOUTH BEND LATHE, INC.
SOUTH BEND 22, IND.

Builders of Lathes • Milling Machines • Shapers • Drill Presses • Pedestal Grinders



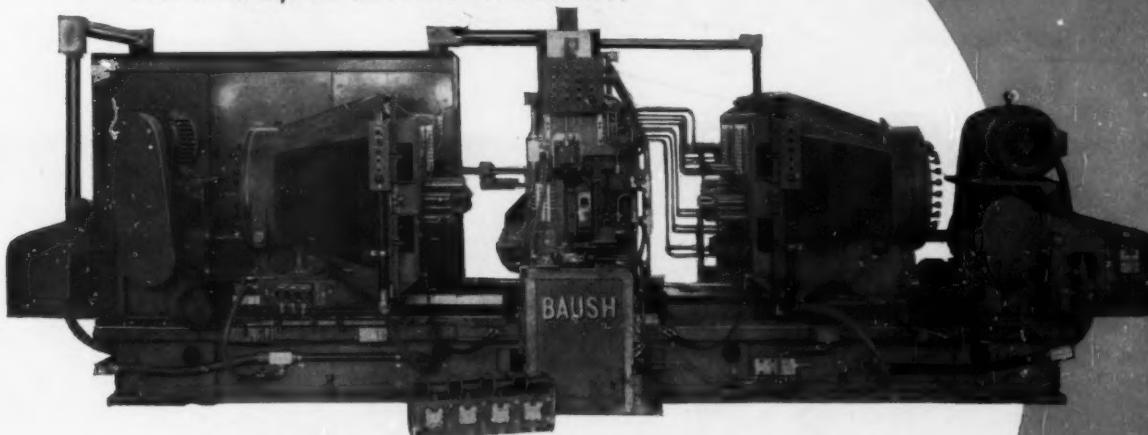
IRREGULAR HYDRAULIC FEED vs- SMOOTH, CLEAN MECHANICAL FEED—

is easy to recognize when you watch machines like this BAUSH 2-WAY HORIZONTAL "M-25" MECHANICAL SCREW FEED in operation, because - - -

- No hydraulic fluid is needed — a real savings
- No fluid leaks or feed fluctuations — reduces maintenance
- No "break-thru" surge — reduces work spoilage
- Positive, smooth ball-screw feed — saves breakage
- Part spoilage and tool breakage is reduced to minimum
- Your own mechanic can maintain units — reduces cost

PRODUCTION:

Designed specifically for drilling, counter-boring, reaming and forming valve seats, this machine finishes 12 cylinder heads an hour when machining injector holes, and 18 per hour when injector holes are not machined.



SPECIFICATIONS:

This Baush machine is fully automatic — has two 27" x 50" drilling heads with a total of 76 spindles with each spindle arranged for two speeds and a neutral position. The master-bored cluster plates have slip-sleeve spindles and entire unit has Trabon lubrication throughout.

Fixtures are transfer bar type; fully automatic to accommodate three different size cylinder heads. Base is arranged for chip conveyor disposal and the 5 motors and electrical controls are J.I.C.



BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

For quiet operation...

DE LAVAL



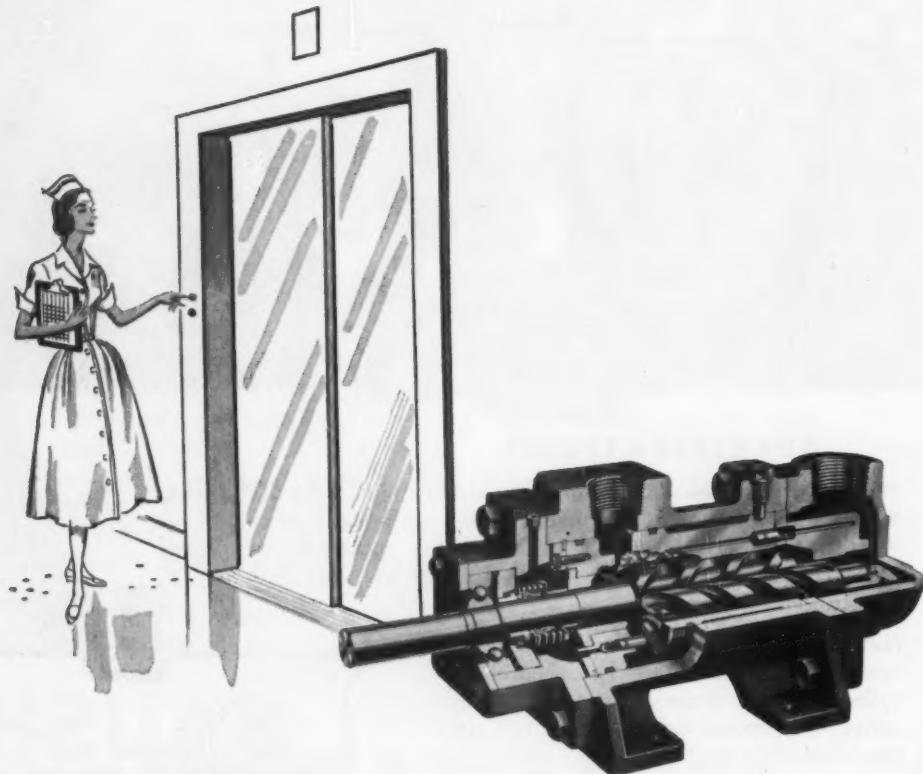
**power-hydraulic
pumps**

The smooth rolling action of De Laval IMO pumps eliminates noise, vibration, and hydraulic whine. There are no reciprocating parts to wear and become noisy. "Hospital quiet" is assured. This is why the noise-conscious elevator industry has virtually standardized on the IMO pump for hydraulic passenger elevator installations . . . and the U. S. Navy uses IMO pumps for practically every submarine service.

Versatile IMO pumps deliver maximum profitability in many varied power-hydraulic applications. Besides quiet operation, IMO pumps offer non-pulsating flow, high speed, wide capacity range, and reliability . . . even with fire-resistant fluids. Compact design saves expensive floor space. Installed cost is lower than for other types of pumps. IMO pumps cut maintenance, too . . . only three moving parts!

For application and performance data, selection information, dimension drawings and tables, write for Bulletin IM-3200.

De Laval Steam Turbine Company, Trenton 2, New Jersey.



IM-DL-101

DE LAVAL • 60 YEARS OF CREATIVITY AND QUALITY

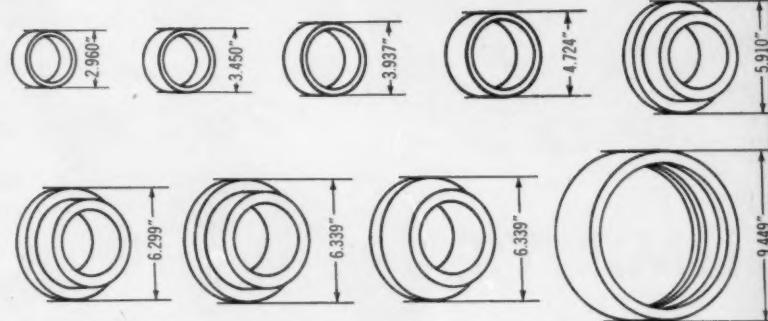
CENTRIFUGAL PUMPS AND COMPRESSORS • TURBINES • IMO® ROTARY PUMPS AND HYDRAULIC MOTORS
MARINE PROPULSION AND AUXILIARY EQUIPMENT • HELICAL AND EPICYCLIC GEARS • TURBOCHARGERS

For more data, circle this page number on Readers' Service Card.

MACHINERY, September, 1961

DISC GRINDS 9 DIFFERENT BEARING RACES

tooling on 2H30 handles
bearing races from
2.9" to 9.4" diameter



Gardner 2H30 Precision Double Spindle Disc Grinder with feed thru fixturing.

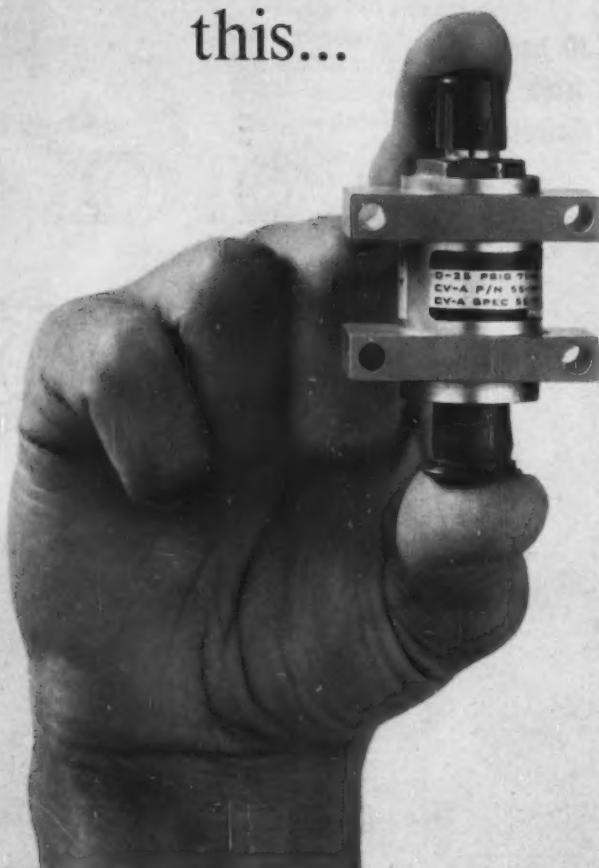
grinds **two** sides parallel in **one** operation

GARDNER

precision disc grinders

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

How Convair-Astronautics keeps track of this...



(and 84,999 other missile parts)



The Manufacturing Control Department at Convair (Astronautics) Division of General Dynamics Corporation has a monumental problem: how to keep track of the movement of over 85,000 individual missile parts.

The solution: *automated data preparation* by means of a Friden Collectadata® system. Situated in key plant locations, Collectadata

transmitters report virtually all parts movements—over 5000 every day—to central Collectadata receivers which record them into punched paper tape. At day's end the Collectadata tapes are fed into the electronic computer at Astronautics for further data processing.

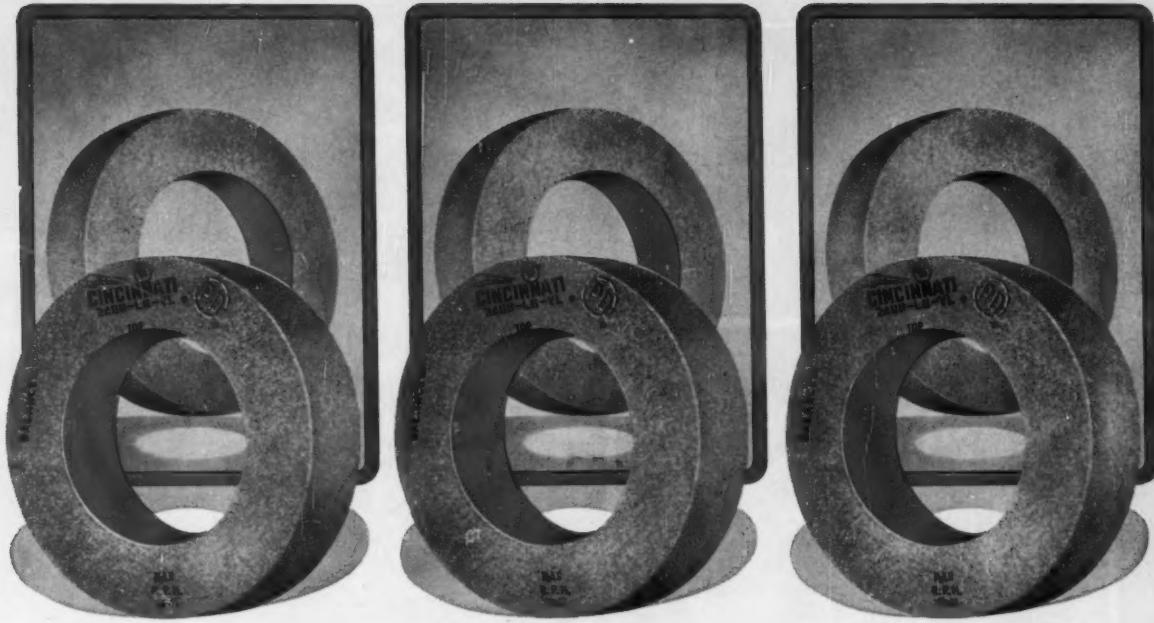
This is what Astronautics says: "The Collectadata has been in use at Astronautics for less than a year. But by eliminating tedious manual paperwork, and by assuring prompt processing of all inventory reports, it has already saved considerable time, trouble and money."

How much could Collectadata save you? Call your Friden Systems Man, or write: Friden, Inc., San Leandro, Calif.

THIS IS PRACTIMATION: automation so hand-in-hand with practicality there can be no other word for it.

*Sales, Service and Instruction
Throughout the U.S. and World*

Friden



POSITIVE DUPLICATION—EVERY TIME!

Just as you see these CINCINNATI Centerless Grinding Wheels duplicated with exact fidelity in these mirrors, you can be absolutely sure of Positive Duplication with *all* CINCINNATI GRINDING WHEELS.

THREE DOZEN GOOD REASONS

Cincinnati is able to supply you with wheels of uniform excellence, because of its unique manufacturing process. This involves 36 separate and unvarying quality controls right from grain mix to final inspection.

For example, the six steps to grain uniformity are these: Grain size verified with screens . . . Grain cleanliness . . . Freedom of foreign matter . . . Color . . . Magnetic content . . . and Bulk density must all meet rigid standards.

RESULT: DEPENDABLE PERFORMANCE

You can *depend* on WHEELS because each reorder

wheel gives you exactly the same good job as the original.

Using WHEELS you will find production going up, and costs going down . . . *to stay!* This is the promise—and the performance—of Positive Duplication.

CALL FOR CINCINNATI WHEELS TODAY

Solve your grinding problems with the help of specialists trained by the Cincinnati Milling Machine Company. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI GRINDING WHEELS Distributor or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.



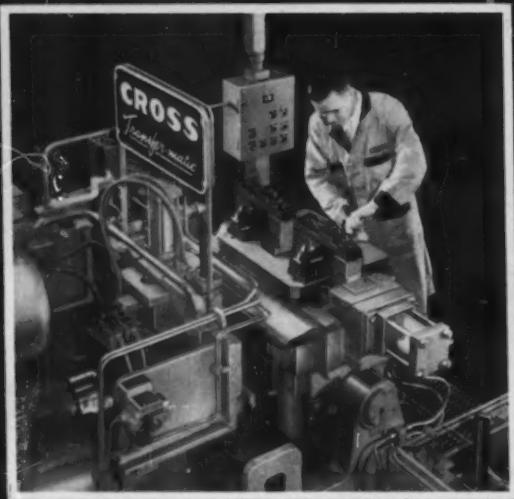
POSITIVE DUPLICATION

CINCINNATI
 GRINDING WHEELS

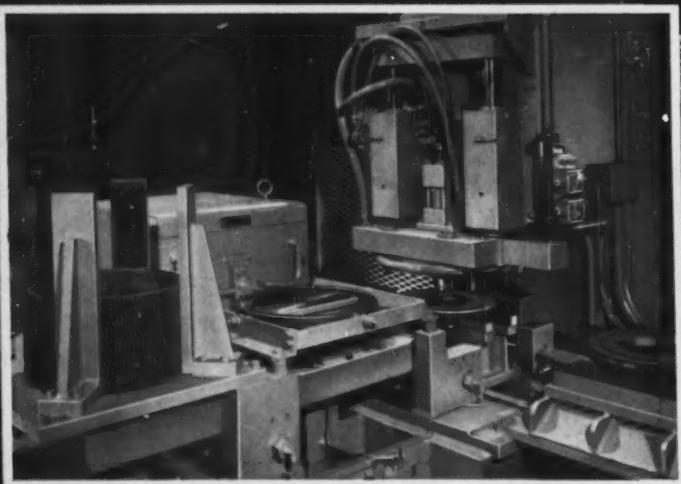
A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

For more data, circle this page number on Readers' Service Card.

*Trade Mark Reg. U.S. Pat. Off.



In Section I, tool slide units pivot to a convenient position for ready access to cutting tools.



The ring gears, slacked at the left, are heated in an induction coil in the center, pressed on the flywheel at the right and shrunk in position by a cold air blast.

Another Automation First by Cross

Transfer-matic Completely Processes Flywheels and Assemblies Ring Gears

Machining Operations Include Facing, Turning, Boring, Chamfering, Drilling and Tapping

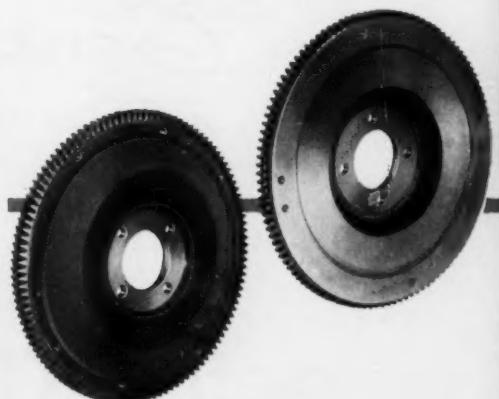
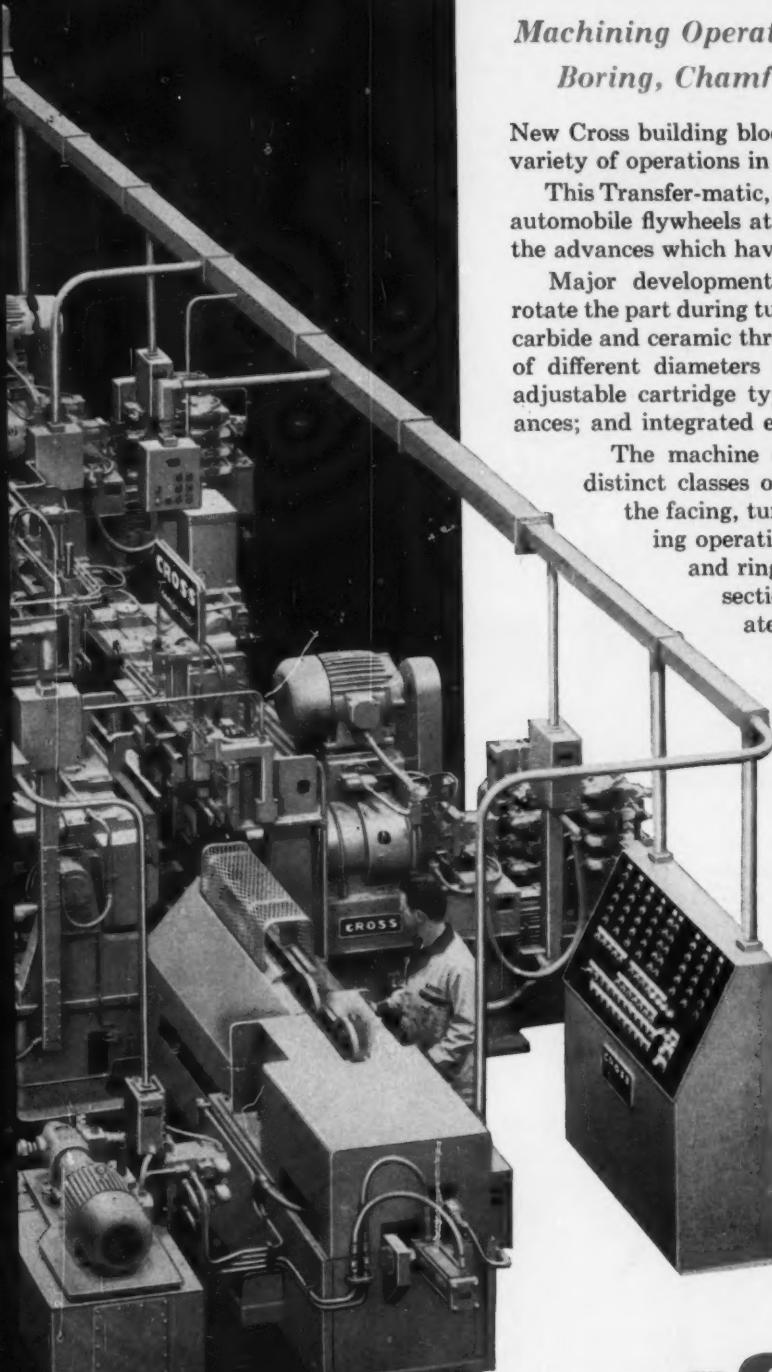
New Cross building blocks make it possible to complete a wide variety of operations in addition to drilling and boring.

This Transfer-matic, which completely processes two different automobile flywheels at the rate of 132 per hour, is evidence of the advances which have been made.

Major developments include standard chucking units to rotate the part during turning, facing, and boring; the use of both carbide and ceramic throw-away inserts to assure proper cutting of different diameters at a single spindle speed; individually adjustable cartridge type tool holders to maintain close tolerances; and integrated equipment to assemble the ring gear.

The machine consists of two sections to handle two distinct classes of operations. The first section performs the facing, turning, boring, undercutting and chamfering operations. Drilling, reaming, tapping, cleaning and ring gear assembly take place in the second section. The two sections are normally operated as one machine. A banking station between sections permits either to continue when the other is stopped for tool changes.

Quick changeover for the two flywheel designs is achieved by such features as the use of eccentric spindles to machine different hole patterns.



Established 1898

THE **CROSS** CO.
First in Automation
PARK GROVE STATION • DETROIT 5, MICHIGAN



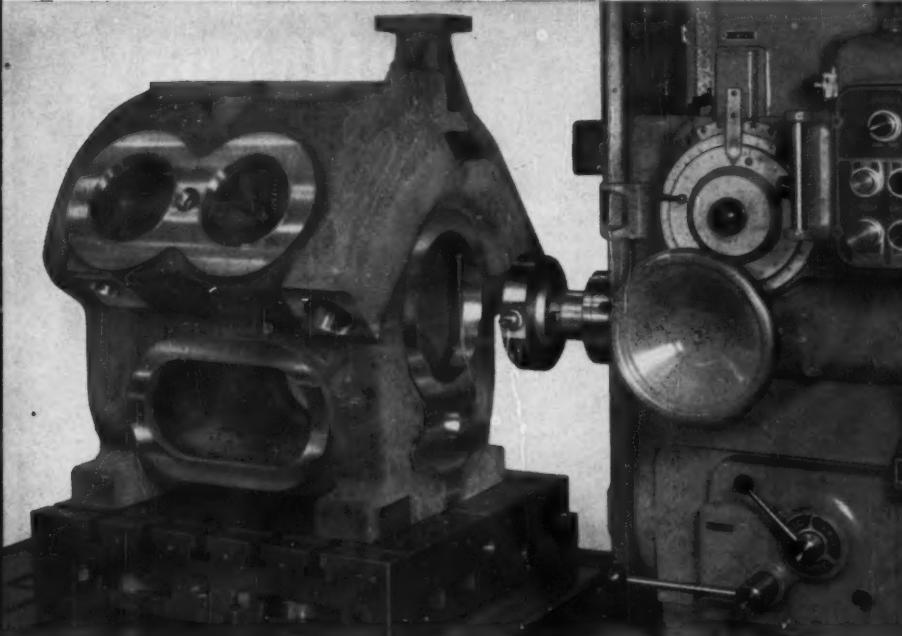
Gone to Fair street...

DE VLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

Why did he drop everything and go? Because he couldn't afford not to. He had just received a very remarkable report on the DeVlieg JIGMIL and the DeVlieg Philosophy of Precision Machining. He's got to find out whether such tremendous cost-saving performance can really be true. If there's a better way of doing things, he wants to know about it . . . put it to work for his company. That's one reason why his company is so healthy . . . so far ahead of competition.

SOME OF OUR JIGMIL USERS

ACF Industries, Inc.
Allis-Chalmers Mfg. Co.
Allring-Landers Co. Inc.
Bell & Gossett
Bethlehem Steel Corp.
Brunner Corp.
Caterpillar Tractor Co.
Champlain Corp.
DeLaval Co.
The Deming Co.
Dodge-Glaser, Inc.
Franklin Machine Co.
Gardner-Denver Co.
Harnischfeger Corp.
Hupp Aviation Co.
Hyster Co.
Ingersoll-Rand Corp.
International Harvester Co.
Koppers Co.



Basic Principles in the DeVlieg Philosophy of Precision Machining

- A Machine Tool capable of desired accuracies
- Correct Tool Geometry
- A Method of Tool Preparation and Maintenance

Only DeVlieg Delivers the Complete Package!

Seeing is believing. Compressor housing for an industrial air conditioning system being machined on a DeVlieg Spiramatic JIGMIL. Accurate holes and flat surfaces are extremely critical in the part to prevent leakage of Freon gas. Part is programmed on a model 3B-48 standard JIGMIL with 26" x 26" index table and Microbore tooling. Machining operations include complete rough and finish milling and boring in three set-ups of the part. The DeVlieg system provides a finished part in approximately five hours. Much faster than machining methods previously used!

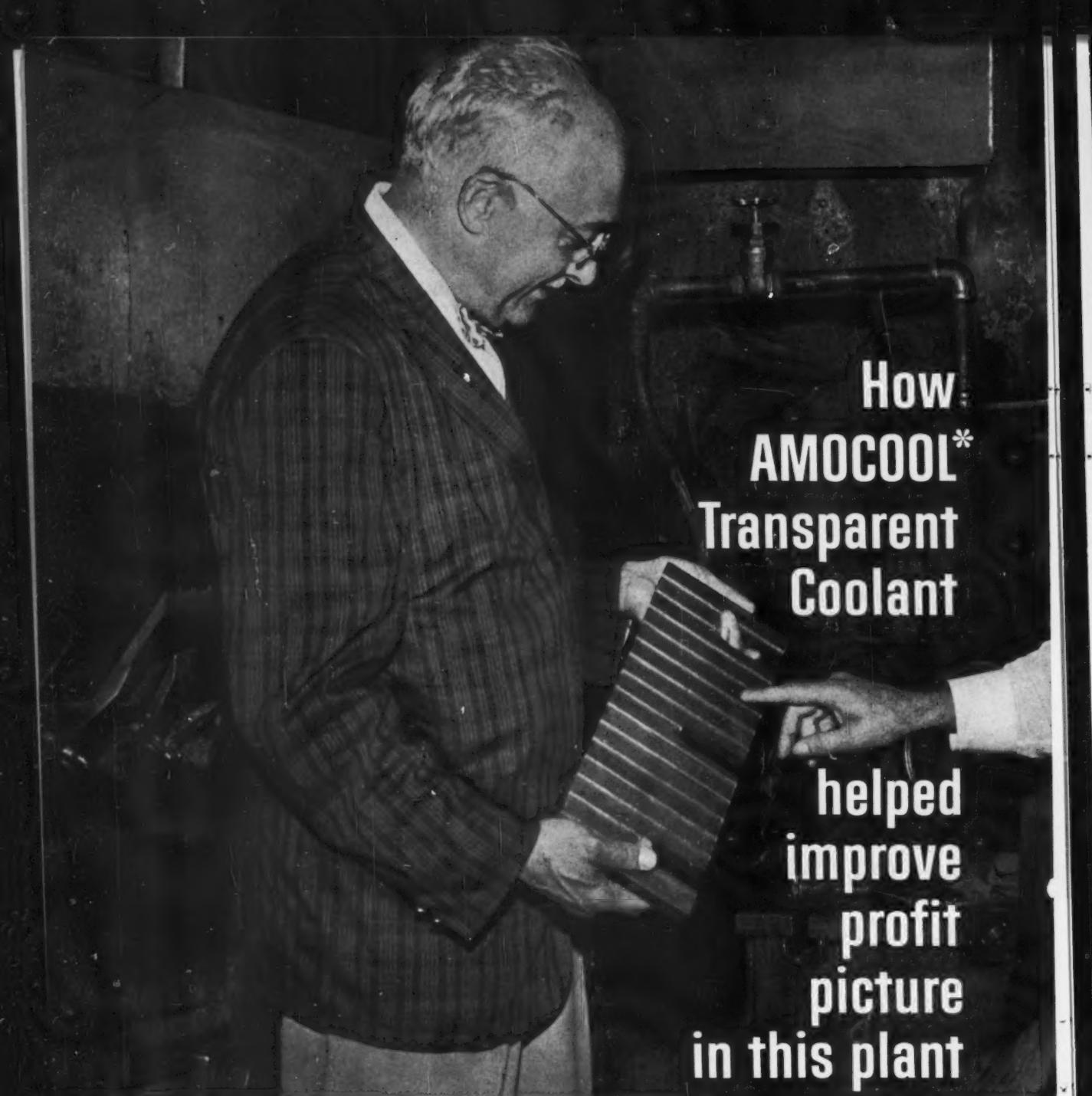
Ladish Co.
F. Joseph Lamb Co.
LeTourneau-Westinghouse Corp.
J. Leukart Machine Co., Inc.
Manning, Maxwell & Moore, Inc.
Marc Precision Tool Co.
National Supply Co.
New Jersey Machine Corp.
Practical Machine Co.
Saco-Lowell Shops
Sandia Corp.
Union Carbide Nuclear Co.
Van Vlaanderen Machine Co.
York Div., Borg-Warner Corp.
Worthington Corp.

WILL YOU BE THE NEXT TO VISIT FAIR STREET



DeVlieg SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES
IN PRECISE LOCATIONS



How AMOCOOL® Transparent Coolant

helped improve profit picture in this plant

®Trademark

BY PAUL E. "PAPPY" STRATTON

About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been work-

ing for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.



By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.



This is
AMERICAN OIL COMPANY
in action

Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

Quick facts about

AMOCOOL

Transparent Coolant

- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant
- Odorless



**AMERICAN OIL
COMPANY**

910 South Michigan Avenue
Chicago 80, Illinois

"The No. 3's split the tenths!"

So report users of Moore's New Jig Borer and Jig Grinder



"Our operators feel that these are the best machines they have ever worked on. They take care of the tenth-splitting tolerances required by industry today. Over the years we have enlarged our Moore Jig Boring and Jig Grinding Department to 15 machines." These are the words of Herbert Harig, President (left above), and Karl Harig, Chairman (at right), Harig Manufacturing Corporation, Chicago, Illinois.



Among the highly skilled toolroom operators in the Federal Products Corporation, Providence, Rhode Island, is this talented jig grinder operator, Mrs. Florence Smith. Mrs. Smith achieves ultra-precise results with the No. 3 Moore Jig Grinder.

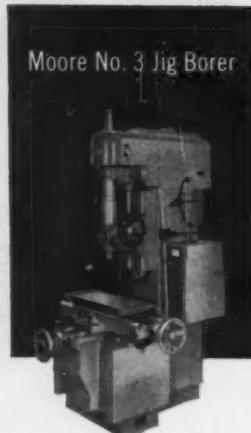


HOLES, CONTOURS AND SURFACES,
Moore's authoritative book, tells how to
produce tools, dies and precision
parts the modern way.

424 pages, 495
illustrations. \$5
in U.S.A.,
\$6 elsewhere.

ADD MOORE TOOLS

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES



Moore No. 3 Jig Borer



Moore No. 3 Jig Grinder

You will easily break the "tenth" barrier with this accurate machine. No gibbs...no overhangs...improved drive...speed range of 60 to 2250 RPM...11 x 24" table working surface. It bores, drills, reams and spots holes in dies, jigs and production parts with unequalled speed and accuracy.

With this new, larger No. 3 model, you can grind—with split-tenth accuracy—holes plus regular and irregular contours to size and location after hardening. Faster strokes are provided for chop-grinding...infinite spindle speeds, 40 to 250 RPM...larger table working surface, 11 x 24".

All hardened, ground and lapped ways. Made and calibrated to the new international inch.

Write today for literature describing the many advantages of the No. 3 Moore Jig Borers and Jig Grinders.

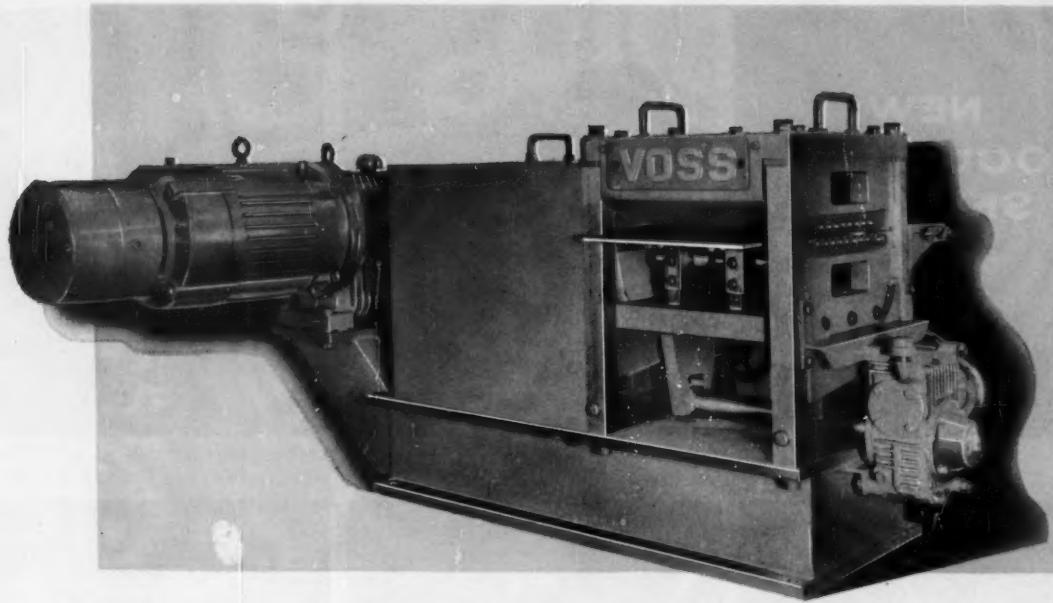
MOORE SPECIAL TOOL COMPANY, INC.

300 Union Avenue, Bridgeport 7, Conn.



"We have found that it costs real dollars and cents to operate without Moore equipment. This cost factor is just one of many reasons why we recently added the new Moore Model No. 3 Jig Grinder. This Machine, with its tenth-splitting accuracy, hardened ways and wider range, enables us to service more customers better." Statement by Val Koller, President, Koller Die & Tool Co., Milwaukee, Wisconsin.

TO YOUR TOOLROOM



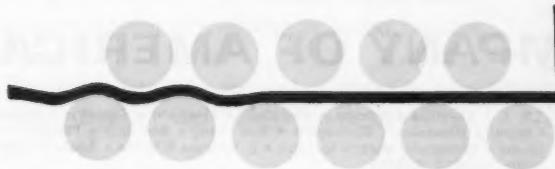
HERE'S THE MACHINE THAT'S REVOLUTIONIZING STAMPED PARTS-FLATTENING*

DEAD FLAT—FAST! That's what the Voss stamped parts-flattener does. As fast as it's fed, it achieves within .005 of dead flatness—in one pass. Eliminates hand flattening on an enormous variety of stamped parts. Can even be engineered to flatten parts having irregular surfaces.

COMPACT: Most models are compact enough to sit on a desk top. Yet the flattener inherits the ruggedness of the famed Voss Precision Roller Leveler.

* One major user reports that 2 Voss parts-flatteners and a few operators have replaced 300 workers engaged in hand flattening operations.

We'll be glad to arrange a demonstration with your parts, without obligation.



Voss ENGINEERING CO.

7301 Penn Ave. Pittsburgh 8, Pa. Churchill 2-4422

(Makers of the Voss Precision Roller Leveler)

NEW TOOL STEEL SERVICE

helps you
estimate costs
more accurately!



Estimating tooling costs, especially on new jobs,



becomes more accurate and profitable with Crucible's new Tool Steel Service.



This service enables you to use fewer grades of tool steels...



which you get to know inside-out! So, you can more accurately predict



machining and bench time, and response to heat treating.



And because you're completely familiar with all the basic grades you use...

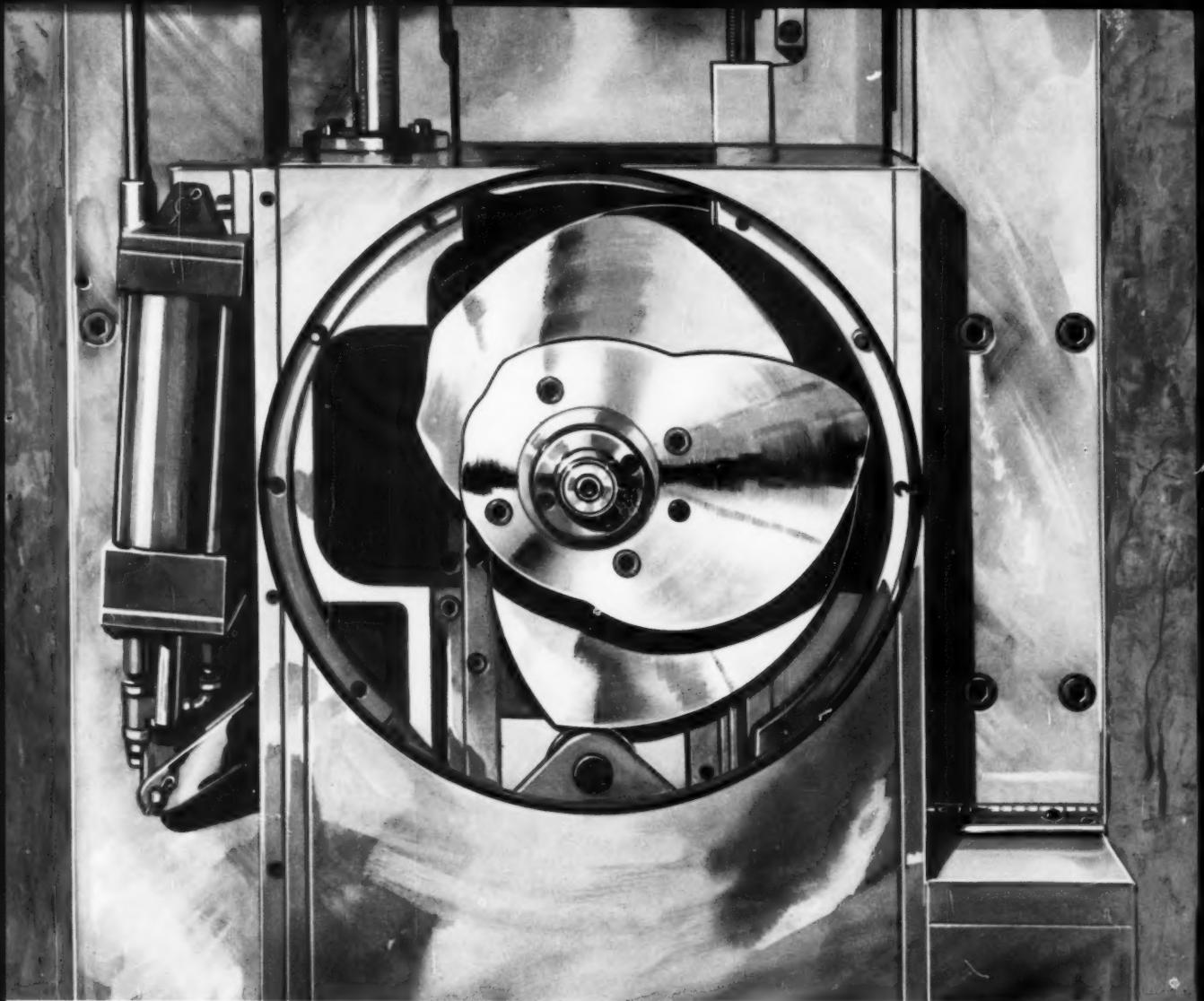


you can pin-point your estimates and your actual costs.

For the complete story on all the cost reductions available with this service, call in a CRUCIBLE Service Engineer.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Caldwell, N. J. • Charlotte • Chicago • Cincinnati • Cleveland • Columbus • Dallas • Denver • Detroit • Erie, Pa. • Grand Rapids • Houston • Indianapolis • Los Angeles • Miami • Milwaukee • Minneapolis • New Haven • New York • Philadelphia • Pittsburgh • Portland, Ore. • Providence • Rockford • Salt Lake City • San Francisco • Seattle • Springfield, Mass. • St. Louis • E. Syracuse • Tampa • Toledo • Tulsa
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA



Exclusive New Britain design for greater boring accuracy

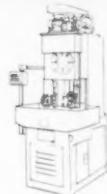
This is the vertical slide of one of the new series New Britain Vertical Contour Turning and Boring Machines with the front plate removed exposing the cams. These cams are mounted on a common shaft which rides with the vertical slide controlling its motion as well as the motion of the cross slide. Containing all slide actuating forces in the vertical slide is an exclusive New Britain feature which represents a major development in boring machine design.

No outside forces are imposed on the slide ways. Extreme accuracy and rigidity are achieved per-

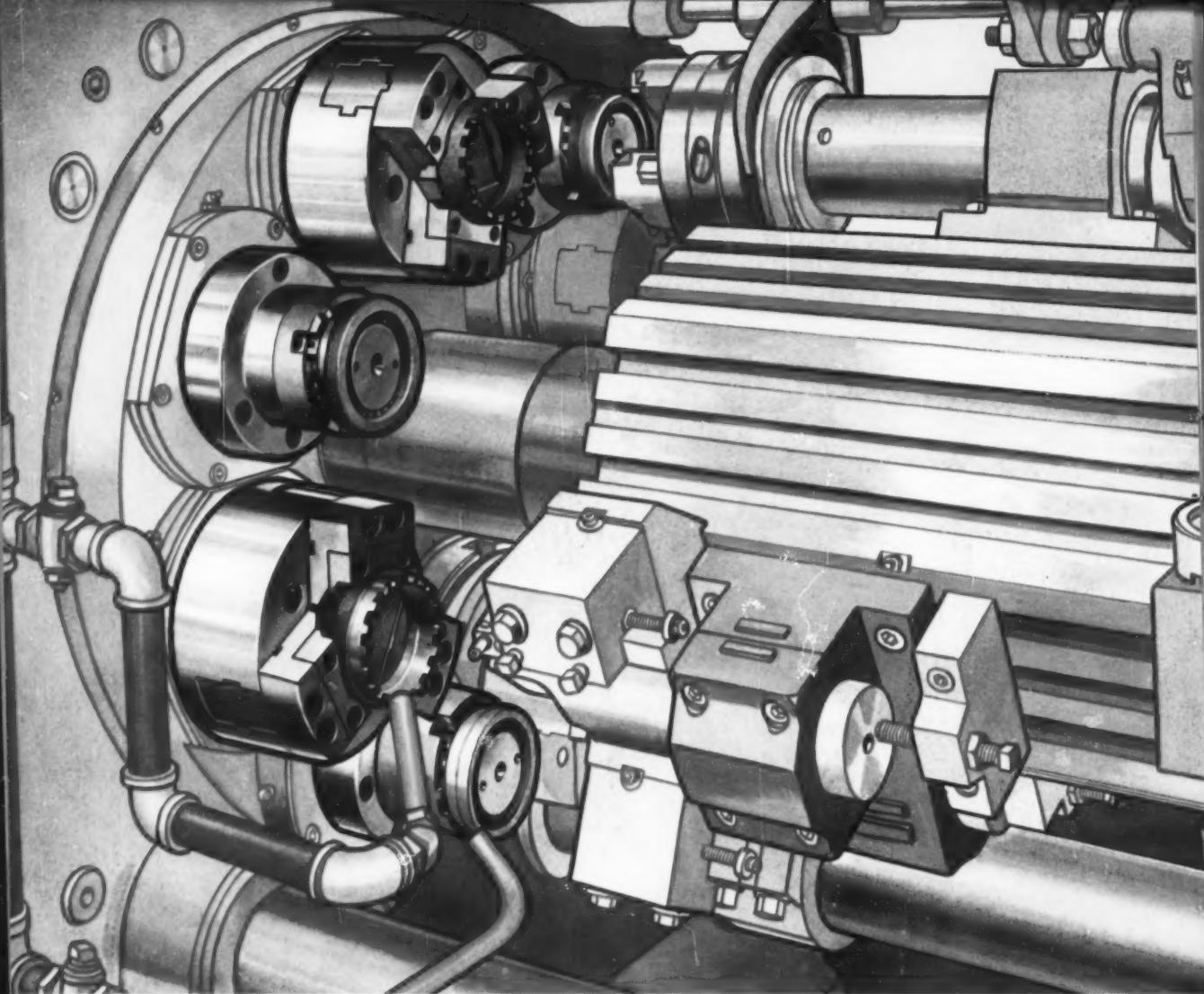
mitting heavy cuts. Finish cuts of less than .0003 tolerance can be made on the same set-up.

The elimination of long actuating linkages has allowed for the design of a compact, clean sided, simplified machine. Cams are quickly accessible and easy to change.

The major improvement which the cam-in-head principle makes on the already widely accepted superiority of cam control results in high repetitive accuracy regardless of the complexity of the piece. Building-block applications, using more than one machine side by side, allow all kinds of possibilities for increased production efficiency.



THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut



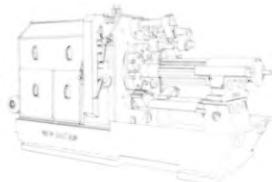
Double indexing... differential chucking pressures with *New Britains*

Here are two features that go a long way toward indicating how much and what kind of work you can do on New Britain's Chuckers. The double indexing feature is a really workable approach to the production of two identical pieces per cycle or both sides of a piece. This application can frequently eliminate the need for second-operation machines. Chucking pressures can be adjusted so that as the machine progresses through the cycle, and more and more metal is removed, the piece will not be distorted.

These are only two of a dozen different New

Britain Chucking Machine features. These rugged, powerful machines are your best bet for high production turning, forming, facing, threading, tapping and related operations. New Britain's complete line of chuckers includes four-, six- and eight-spindle models, with work swing up to 17 inches. Wide open design in all models allows for the quickest possible disposition of chips.

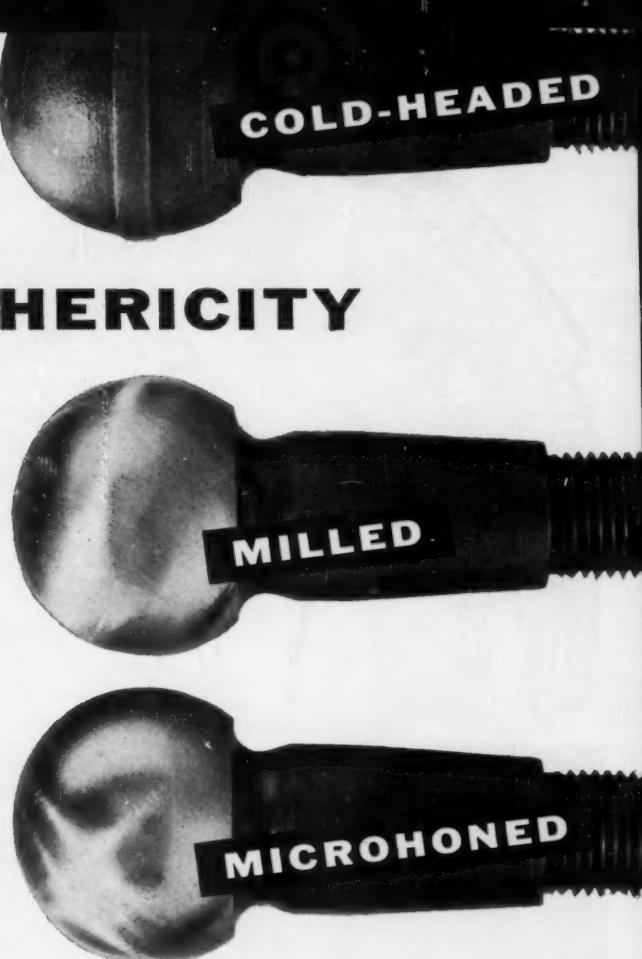
Make a point of calling in your New Britain representative soon. Let him show you the dollars and cents reasons for including New Britains in your replacement or expansion plans.



THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut

.0003" SPHERICITY

from
cold-headed
to
finished surface
... in just two operations



True sphericity, with closer control of size and surface finish than previously possible, is accomplished in only two cost-cutting operations by the new Micromatic process for machining truncated spheres.

The only machining operations on the spherical end are milling and Microhoning. Combining new techniques with specially developed spherical milling and Microhoning machines, the process generates sphericity within .0003" tolerance and a controlled microinch finish of 6-10 rms. (Former methods were hard pressed to productively obtain sphericity within .002".)

All the machining and polishing operations—such as turning, grinding, buffing—which old processing methods required on the spherical end are eliminated. Also, some operations on other parts of the workpiece (e.g., turning and grinding of the taper shank) are no longer necessary.

The new method can be applied to any truncated sphere which has a shank or bore to permit holding without touching the sphere. Micromatic will be happy to show you the dramatic savings being enjoyed by leading production plants using its spherical process.



Shown at left is a clutch release lever before and after spherical milling. In this case, accuracies and surface finish milled are perfectly satisfactory for assembly without further processing of the sphere.



**MICROMATIC HONE
CORPORATION**

8100 SCHOOLCRAFT • DETROIT 38, MICHIGAN



COOK OUTS

and two **Verson** presses
help balance production
at Structo Manufacturing Company

Seasonal production problems can be tough and costly. Structo Manufacturing Company, Freeport, Illinois, solved such a problem. As the world's largest manufacturer of heavy gauge steel toys, Structo balanced its production of toys for the Christmas market with the production of barbecue grills for the summer market. Two 350 ton Verson crank presses are the key units in the grill production set up.

If you have production balancing problems, talk to your Verson Representative. He will be glad to show you how Verson equipment can help you in balancing production.

Originators and pioneers of allsteel stamping press construction
VERSON ALLSTEEL PRESS CO.

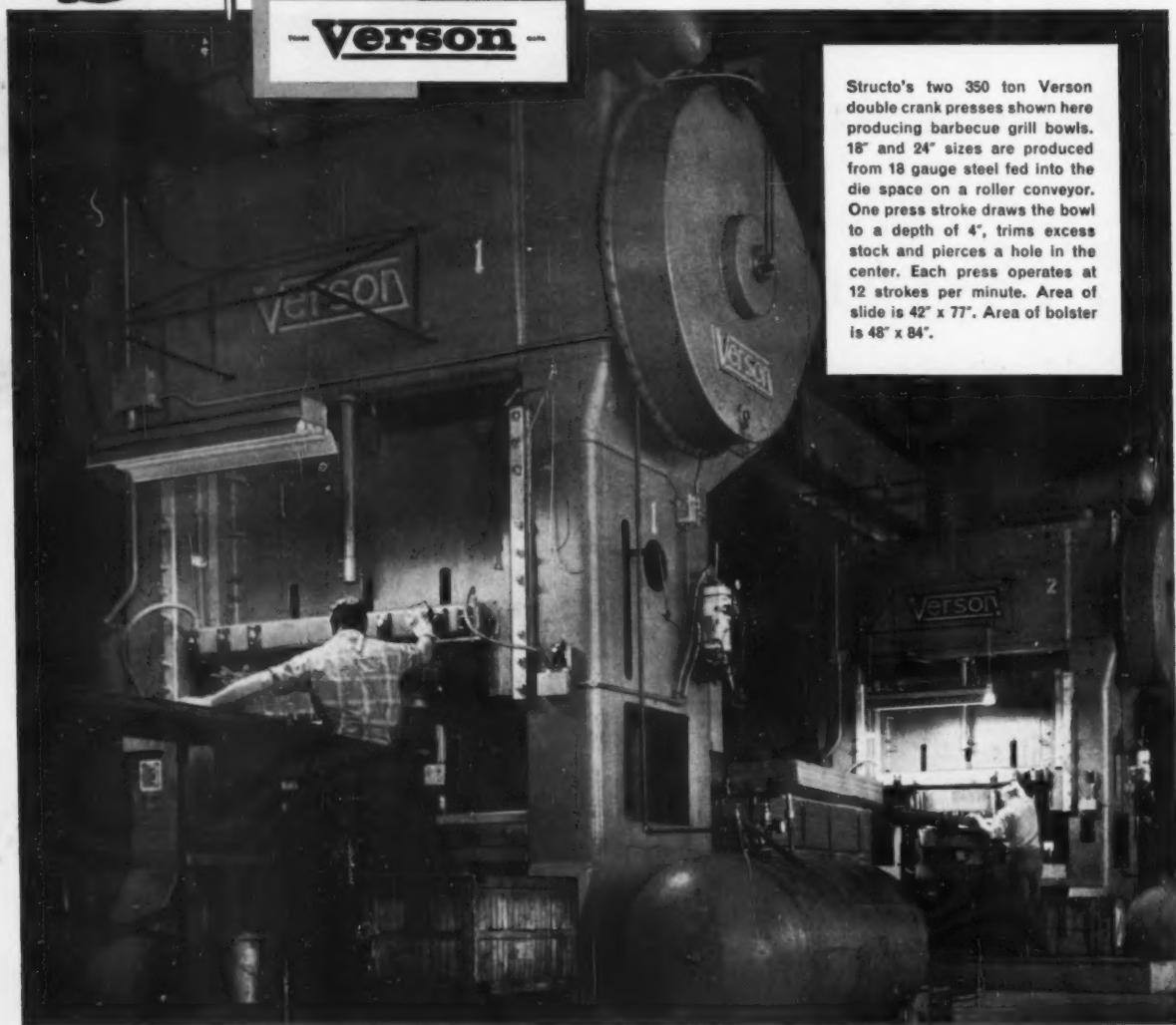
9309 S. Kenwood Ave., Chicago 19, Ill. • 8300 S. Central Expressway, Dallas, Tex.

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES
TRANSMAT PRESSES IMPACT MACHINING PRESSES TOOLING DIE CUSHIONS
VERSON-WHEELON HYDRAULIC PRESSES HYDRAULIC SHEARS PLASTIC MOLDING PRESSES

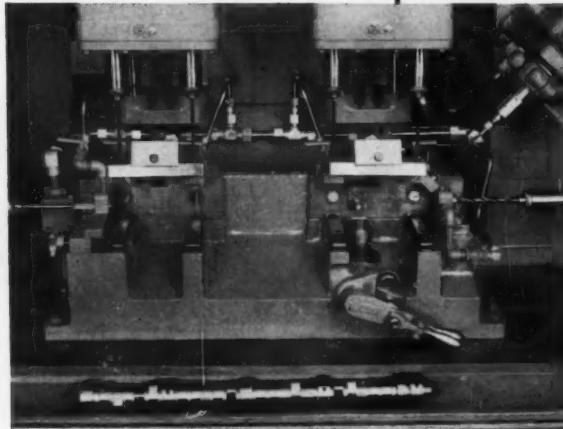
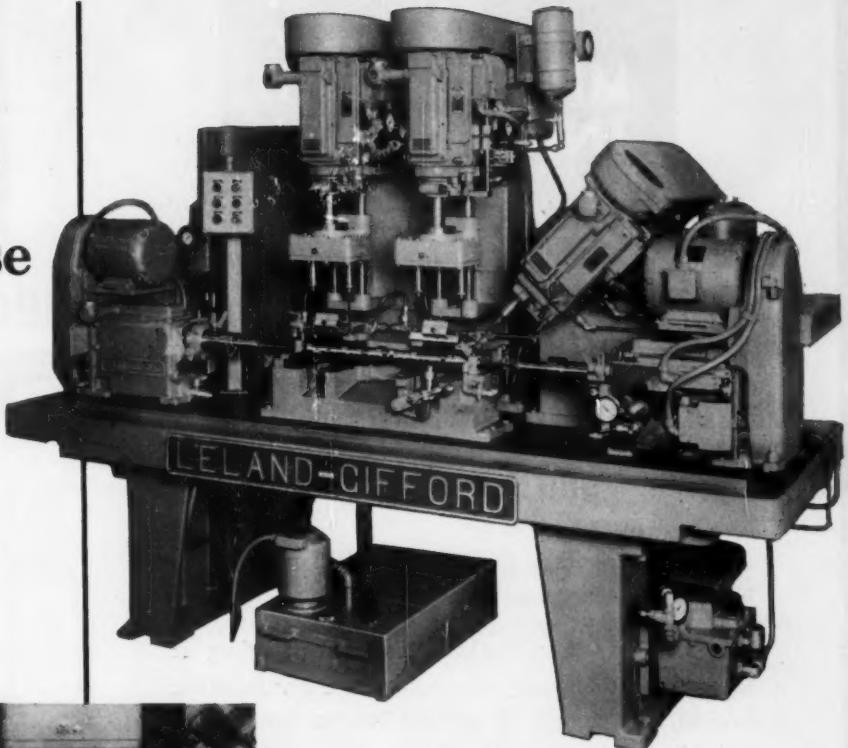
264

-Verson-

Structo's two 350 ton Verson double crank presses shown here producing barbecue grill bowls. 18" and 24" sizes are produced from 18 gauge steel fed into the die space on a roller conveyor. One press stroke draws the bowl to a depth of 4", trims excess stock and pierces a hole in the center. Each press operates at 12 strokes per minute. Area of slide is 42" x 77". Area of bolster is 48" x 84".



**Here's
an idea
you can use
to cut
precision
drilling
costs . . .**



THE JOB: Drill one end of camshaft and ream the other while drilling four cross holes and one angular oil hole.

THE MACHINE: A Leland-Gifford special with five No. 2 self-contained units and standard hydraulically

One machine, one handling, one quick, simple operation does all the precision drilling on this camshaft. Note that this is not ordinary gang drilling — the job involves axial, angular and cross holes as well as reaming.

Leland-Gifford has time-saving, cost-cutting ideas for you, too — ways you can combine multiple operations into a simple, efficient unit operation.

clamped fixture interlocked with drilling units to start feed after clamping and to unclamp when operation is finished. SC units are interlocked to prevent interference between cross and axial drills. One operator completes 60 camshafts per hour at 100% efficiency.

For Automatic Drilling at its best be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

**LELAND-GIFFORD
SPECIAL
DRILLING MACHINES**

**WORCESTER 1, MASSACHUSETTS
U. S. A.**

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**MITSUBISHI
INNOCENTI
CWB**

milling boring and combined machine

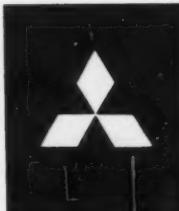
**Universality, productivity
and easy handling....**

are characteristics of INNOCENTI-CWB milling, boring and combined machine.

MITSUBISHI ZOSEN (Mitsubishi Shipbuilding & Engineering Company) manufacture and distribute the FA 140/95 type (dia. of spindle 140 mm for milling, and 95 mm for boring) of this universally-known machine, licensed by INNOCENTI S.G. of Milano.

Overseas Agents

U.S.A.: Pratt & Whitney, West Hartford • **Canada**: Ryder Machinery Co., Ltd., Toronto • **United Kingdom**: Henderson & Keay, Ltd., Glasgow • **France**: Société d'Etudes de Machines Outils, Outilages et Accessoires, Paris • **Switzerland**: A. Ritschard Machines-Outils SA, Geneve • **Norway**: A/S G. Hartmann, Oslo • **Finland**: OY Machinery AB, Helsinki • **Netherlands**: Technische Import & Export J.L. Bienfait, Asterlaan • **Sweden**: Lundwall & Co., Göteborg • **Denmark**: Scandinavian Phoamix A/S, Copenhagen • **Spain**: Liner Sociedad Anonima, Madrid



MITSUBISHI ZOSEN (MITSUBISHI SHIPBUILDING & ENGINEERING CO., LTD.)

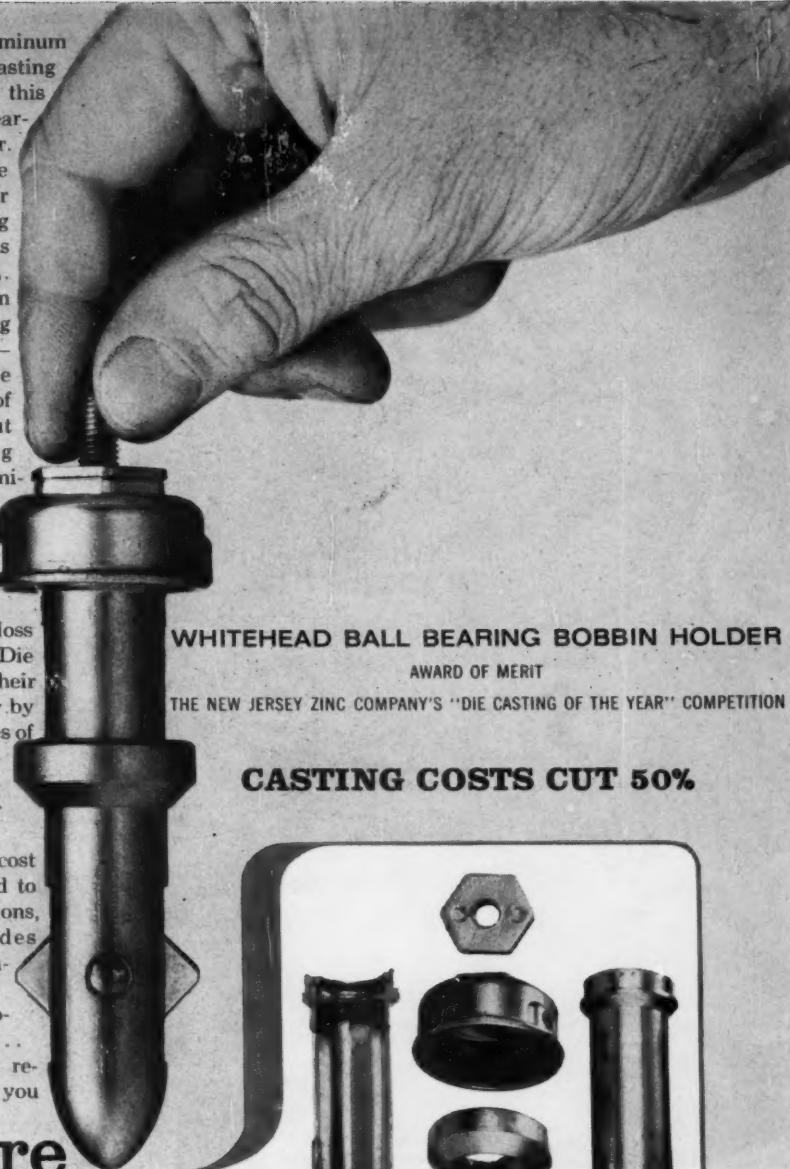
Head Office: Marunouchi, Tokyo, Japan New York Office: Equitable Bldg., Broadway, New York
 Machine tool manufacturing division Sole agent
HIROSHIMA PRECISION MACHINE WORKS **MITSUBISHI SHOJI KAISHA, LTD.**

Switching from aluminum to Zamak sliced casting costs in half on this Whitehead ball bearing bobbin holder. And with seven zinc die castings accounting for all the major working parts, overall costs dropped a neat 12%.

This high volume item is found on spinning frames in cotton mills—it's designed to take twenty to thirty years of rugged, day-in day-out service. Yet by using Zamak instead of aluminum, the wall thickness of certain parts was reduced from .065" to .050". This resulted in a decrease in material cost with no loss in strength. Whitehead Die Casting plans to bring their costs down still further by going to wall thicknesses of .032"—with the toughness of the parts still unaffected as far as their performance goes.

Besides the healthy cost savings directly related to the reduced wall sections, Zamak also provides Whitehead with a familiar success story—"faster and more economical production... longer die life... less rejects." Zamak gives you more for less — — —

are
YOU
getting your
METAL'S
WORTH?



WHITEHEAD BALL BEARING BOBBIN HOLDER

AWARD OF MERIT

THE NEW JERSEY ZINC COMPANY'S "DIE CASTING OF THE YEAR" COMPETITION

CASTING COSTS CUT 50%

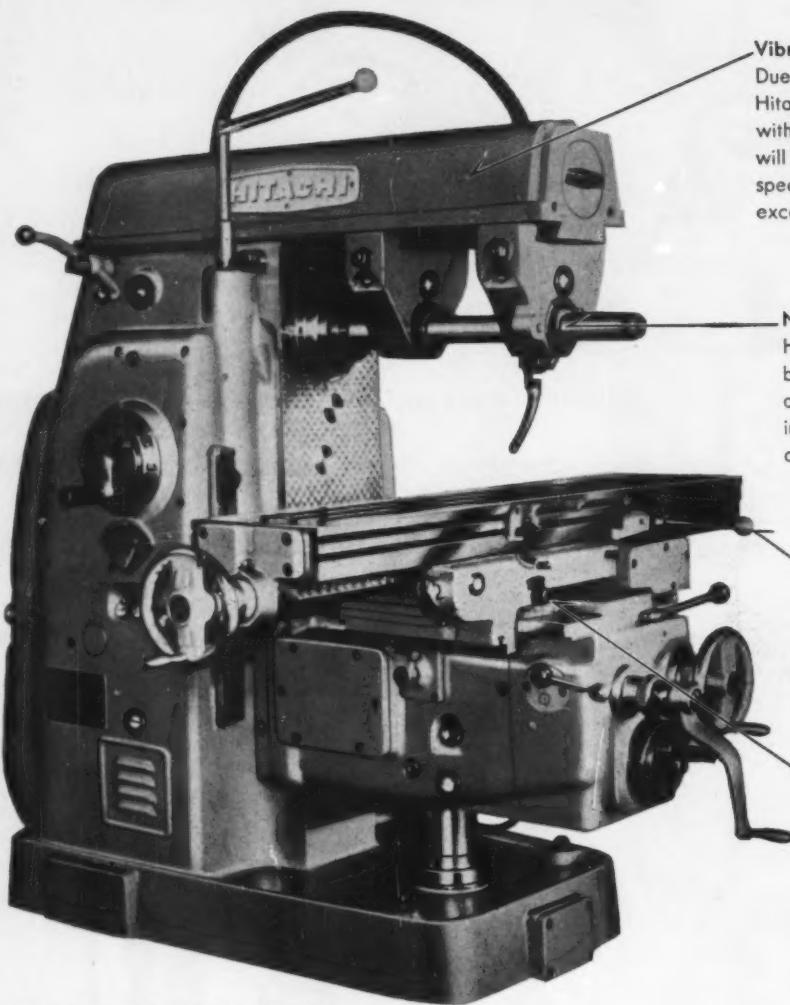


HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY
**THE NEW JERSEY
ZINC COMPANY**
160 FRONT STREET • NEW YORK 38, N.Y.
DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY



HITACHI

NO. 2 ML MILLING MACHINES



No. 2 ML Plain Milling Machine

Vibration Damping Device

Due to a vibration damping device of Hitachi's exclusive design contained within the over-arm, minimum vibration will be set up even during higher speeds and feeds operation, so that an excellent finished surface is obtained.

New-Type Arbor Support Bearing

Hitachi's unique super precision-type bearing, a combination of plain metal and needle bearing, is incorporated into the machine to enable high speed cutting with high precision results.

Mono-Lever Control System

Hitachi's unique Mono-lever Control System makes the operation simple and easy. Table-feeding too can be performed with ease.

Backlash Eliminator of Lead Screw

As the use of two independent nuts eliminates backlash on the table feed screw, smooth down-cutting can be effected.

SPECIFICATIONS :

- 53 1/8"×10 1/16" Table
- 28" Longitudinal Traverse
- 16 Table Feeds 1/16"—78 3/4"/min.
- 16 Spindle Speeds 25—1,500 r.p.m.
- 7.5 h.p. Main Motor



hitachi, Ltd.

Tokyo Japan

Cable Address : "HITACY" TOKYO

so gentle

IT WON'T

CHIP CHINA

So gentle it won't chip china, yet powerful enough to bend steel tubing as if it were a soda straw. In a nutshell, this demonstrates the almost unbelievable degree of control built into Logan air-draulic devices.

The controlled accuracy gives this equipment a versatility and flexibility that makes it adaptable to all kinds of jobs, ranging from precision

laboratory assignments to actual production line work.

If you would like additional information about air-draulic devices or other Logan products, merely fill in the coupon below.

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AIR AND HYDRAULIC OPERATED MACHINES

Check the items you want, fill in your name and address, tear out and mail to:

Logansport Machine Co., Inc. • 790 Center Avenue, Logansport, Indiana

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| <input type="checkbox"/> 100-1 AIR CYLINDERS | <input type="checkbox"/> 200-1 HYD. POWER UNITS |
| <input type="checkbox"/> 100-2 MILL-TYPE AIR CYLS. | <input type="checkbox"/> 200-2 ROTOCAST HYD. CYLS. |
| <input type="checkbox"/> 100-3 AIR-DRAULIC CYLS. | <input type="checkbox"/> 200-3 750 SERIES HYD. CYLS. |
| <input type="checkbox"/> 100-4 AIR VALVES | <input type="checkbox"/> 200-4 and 200-7 HYD. VALVES |
| <input type="checkbox"/> 100-5 LOGANSQUARE CYLS. | <input type="checkbox"/> 200-6 SUPER-MATIC CYLS. |
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BULLARD REVERSES

THE PRICE TREND

with the **NEW** Lower Priced . . .
MULT-AU-MATIC,

with these features:

Type "M"

NEW Simplified Control

NEW Angular Carrier Chip Guards

NEW Larger Chip Capacity

NEW Index Registry

NEW American Standard Spindle Nose

NEW Double Coolant Seal on Spindles

NEW Design Heavy Duty Clutch and
Brake — No Adjustment

NEW Adjustable Power Chucking

NEW Lubrication Filter System

NEW Standard Tooling

All Bearings and Gears
are pressure lubricated

Easy to Service and Maintain

Minimum Floor Space

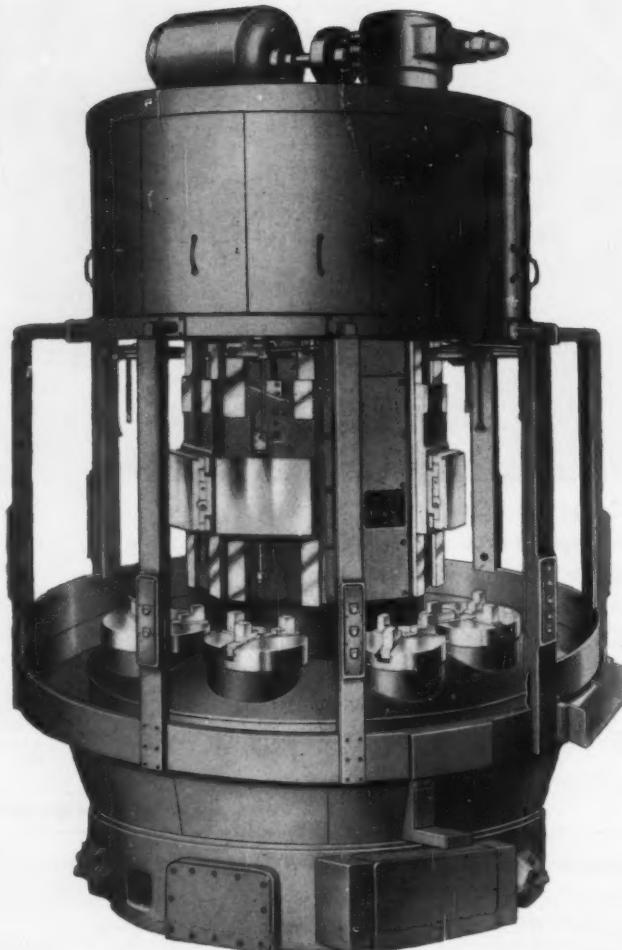
Versatility For Quick Set Up

Uses American Standard Chucks

Maximum Efficiency

Call your nearest Bullard
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The Bullard Company
Bridgeport 9, Connecticut



Every possible element of business ingenuity must be used to run a manufacturing plant at a profit.

Amongst other things, modern machines are available to help maintain a profit. But it takes more than modern machines and methods. It takes, along with other considerations, scientific machinery replacement programs, executed by forward thinking management men. These men have discovered and use formal work sheets which guide them into full and orderly consideration of all factors necessary to profitable replacements.

See how other prominent manufacturers analyze machinery and equipment purchases. Write to any one of the companies in the Rockford Insert Group for the booklet, "Machinery Replacement Programs."

Pursuit
of Profit
in

Manufacturing

September 1961

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Keep gathering
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ideas... be well
informed when you
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THE
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Manufacturers of
Metal Working Machinery

\$24,000 ANNUAL



TOTAL JOB ANALYSIS multiplies savings over conventional cost studies
Charles Bruning Company, well-known maker of copying machines and engineering instruments, can now put an additional \$2,000 per month into product quality without charging their customers an extra nickel! Part of the reason is the MULTICYCLE version of the No. 16-16 hobbing machine. The machine is so simple and automatic that the operator has time to check his own work. Bruning, in effect, gets 100% inspection free. Savings are the result of objective analysis of the total job, and total cost. The hob is as important to the outcome as the machine. The 16 D.P. gear (shown) measures only 1.875" on the OD. But on the No. 16-16 it can be hobbed with a 3 $\frac{1}{2}$ " diam. triple-thread hob. This increases index speed.



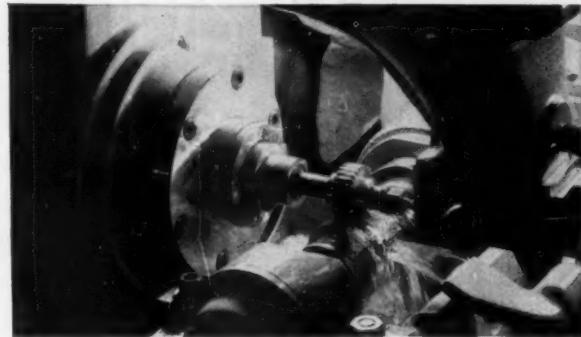
For more data circle No. 861 on Readers' Service Card.

September, 1961

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

Speed is only part of the cost determination. Lowest total cost was Bruning's objective. Reduction of hob approach distance and noncutting time was their answer. Power vertical feed . . . rapid traverse of the workslide and hob carriage . . . and automatic control are three ways to minimize total cycle time. This is the MULTICYCLE concept. Result is conclusive. The right hobs and a modern machine are producing an annual net return of \$24,000. ■ Are your costs pegged high by tradition? A new MULTICYCLE machine often pays for itself as a straight replacement. Choice of three preselect automatic cycles gives you complete general-



SAVING

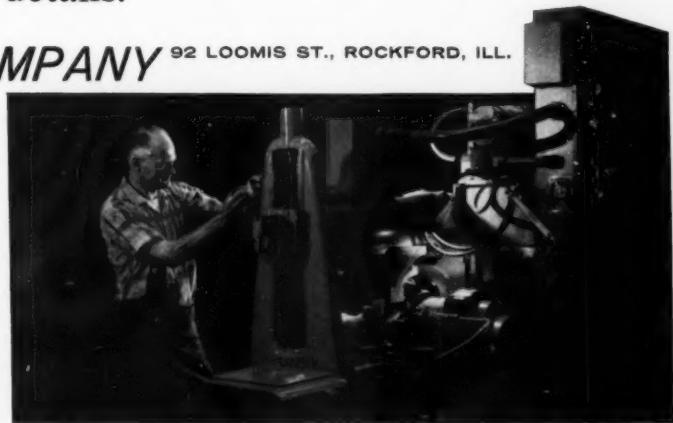
purpose flexibility. Both setup and cycle time are reduced. ■ Take advantage of a Barber-Colman total job analysis. A complete cost evaluation . . . developed from your gear prints and production requirements . . . can be backed by a job simulation for your inspection in our TEST CENTER. Phone your Barber-Colman representative for details.

BARBER-COLMAN COMPANY

92 LOOMIS ST., ROCKFORD, ILL.



Operator checks his own work while the machine is cutting. Side benefit is free 100% inspection.



September, 1961

For more data circle No. 861 on Readers' Service Card.

CITY OF MACHINE-TOOL SPECIALISTS

ROCKFORD, ILLINOIS, U.S.A.



UP TO 200 HP

and tables to 90 inches

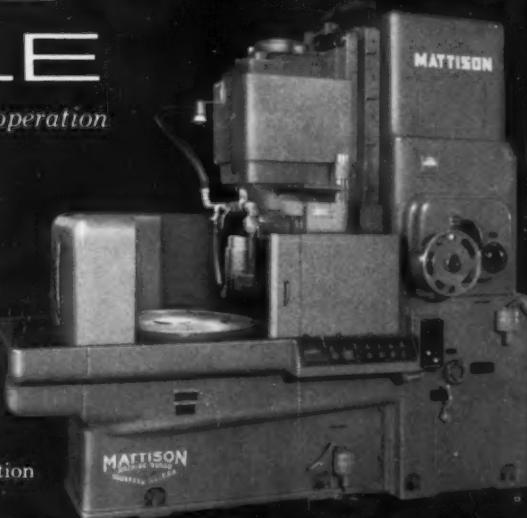
RIGID NEW MATTISONS

with optional automatic cycling and

QUICK TI^LT SPINDLE

combine rough and finish machining in one operation

There's no comparison between these new Mattison Quick-Tilt rotaries and conventional surface grinders. They increase production 50%, or more. They simplify wheel selection, extending the usable range of wheels. They increase wheel life. And they give you both maximum efficiency and perfect flatness on *every* job. Ability to rough grind on the leading edge of the wheel, and then, in a matter of seconds, reset the spindle to its true perpendicular position for a fast finish grind, changes the entire economics of surface grinding. When you combine selector-switch-actuated, power-spindle tilting; downfeeds to .165 in. per minute; up to 200 hp on the spindle; optional automatic cycling; and Mattison's new box-type construction . . . you have a whole *new concept* in flat machining. Stock-removal jobs, formerly milled, planed, or broached, have been switched to these high-powered, versatile rotaries to produce startling savings. We'll be happy to demonstrate — send your pieceparts to the Mattison Methods Lab for a free sample grind and production estimate.



MATTISON MACHINE WORKS Rockford, Illinois
Phone: WO 2-5521

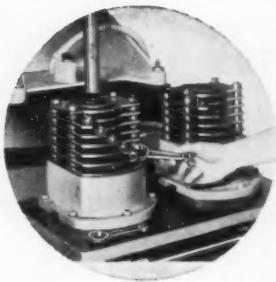


September, 1961

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CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.



QUALITY FOR YOUR PRODUCTS STARTS HERE

What better way to guarantee high quality products than to hone them on precision Barnesdril Honing Machines!

New from top to bottom . . . these machines incorporate every advanced feature gleaned from our 35 years of honing experience.

Greater ruggedness . . . a broader range of capacities . . . more compact design . . . easier maintenance — these are plus-features inherent in every Barnesdril machine to give you precision control at cost-cutting production speeds.

Our new catalog No. 200 gives complete details. Write for your free copy today!



Honing Machines/Production Units
Filtration Units/Drilling Machines

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE • 13121 PURITAN AVENUE

Model 3010 hones up to 10" diameter at full stroke. Choice of 4 strokes. Adaptable for full automation.

Model 122 hones bores up to 2" in diameter at full stroke. Available in 1 or 2 spindles and a variety of fixtures and tables.

Model 244 hones bores up to 4" in diameter at full stroke. Choice of 3 stroke lengths, single or multiple spindles.

OUR FULLY EQUIPPED JOB HONING DEPARTMENT CAN HONE ANYTHING UP TO 25 FEET IN LENGTH. WRITE FOR DETAILS!

QUALITY is insured with correct hone feeds . . . made possible with this easy-to-set infinite hone feed control.

QUALITY at high-production rates means exact spindle speed rates . . . selected with a flick of the fingers.

QUALITY results from correct reciprocation speeds . . . easily selected with this dial or, on the Model 122, a calibrated scale.

QUALITY is automatic with Pneumatic bore-to-bore sizing . . . production size consistency maintained to .0002".

ELIM HONER ASSEMBLY
HONEYCOMB FILTER
SIZING PLUG
TOOL

For more data circle No. 863 on Readers' Service Card.

September, 1961

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



how to improve your milling methods with **SUNDSTRAND "ENGINEERED PRODUCTION"**

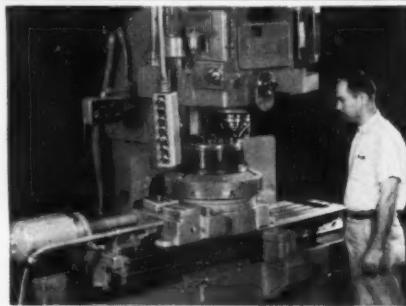
The design of a machine can be a production handicap if it can't be adapted to the production method. With Sundstrand "Engineered Production," method design comes first, machine design second. Rather than try to fit existing machine designs into milling methods, our engineers first determine the most economical milling method. They then

apply the most economical machine design to suit this method. In some cases, standard Rigidmils suit the job at hand. In others, Rigidmils of unit construction are rearranged and modified to suit the method. Where neither of these are applicable, our engineers design entirely special machines for the job. Here are specific examples of each.

1 Standard Rigidmils with fixtures and tooling to suit your work



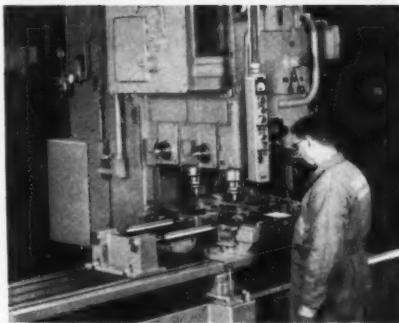
This vertical Rigidmil with standard automatic index base attachment reduced machining time 82% in milling 28 scallops on the periphery of a steel housing. The cycle is fully automatic including indexing. The operator simply loads and unloads the work-holding fixture. The index base can be easily removed so that this standard machine can be used for other work.



2 Rigidmils with special heads and tooling



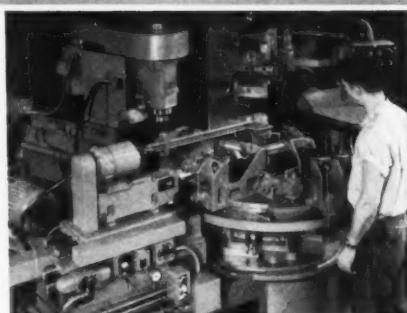
Machining time for keyway milling operations on various shafts was reduced an average of 30% by this two-spindle Sundstrand vertical Rigidmil, milling 2 keyways at a time. Two shafts are clamped side by side in the special fixture, quickly adjustable to handle a wide range of sizes. The number of keyways varies from 1 to 5 per shaft with lot sizes ranging from 50 to 200 pieces.



3 Entirely special machines



This special Sundstrand machine indexes pump bodies thru 5 stations to bore the ID, mill top pad, stamp milled pad, wash, brush and blow out all holes and the inside. All stations operate in automatic cycles simultaneously as operator unloads and reloads. Production of 200 parts per hour with this machine and 1 operator formerly required 4 machines and 4 operators.



SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS

Division of SUNDSTRAND CORPORATION

Milling machines that give you maximum productivity for your machine tool dollar are described in Sundstrand Bulletin 631-1. Write for your copy today.

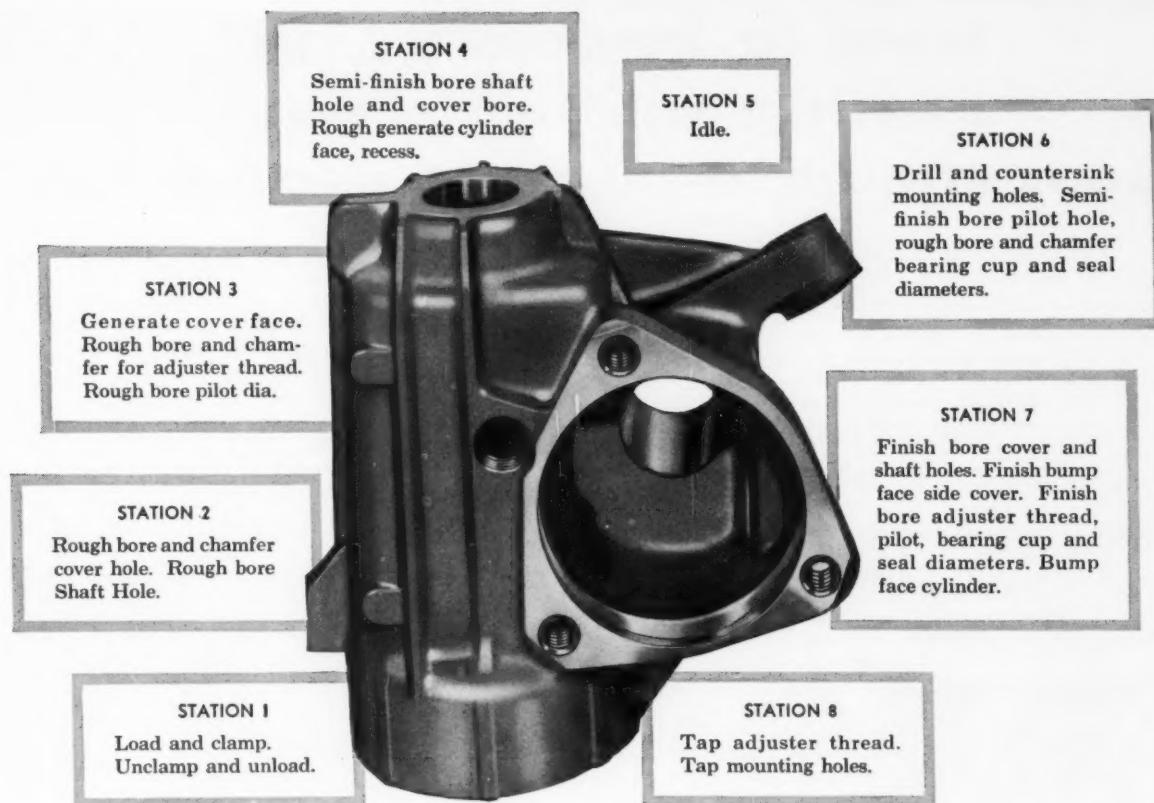


September, 1961

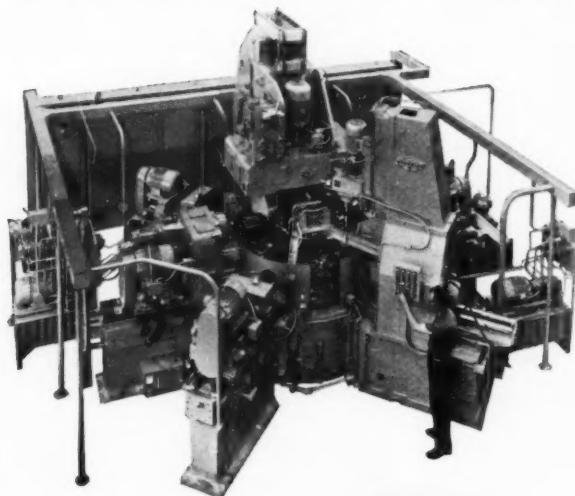
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MACHINES DESIGNED TO MEET YOUR NEEDS

ROCKFORD, ILLINOIS, U.S.A.



153 Aluminum Steering Gear Housings per hour automatically processed on this GREENLEE Machine



This Greenlee 8-Station Horizontal and Vertical Spindle Machine is establishing some excellent performance records for a leading automotive manufacturer. The 52 inch table carries 8 work fixtures. Each has power clamping. To insure rigidity and accuracy, the table is clamped hydraulically metal to metal. Indexing is fully automatic. Cycle time is 23.5 seconds. Like all Greenlee machines it's built for long, continuous service. Can be modified economically if desired. Have our representative give you complete information.

MACHINES DESIGNED
WITH THE FUTURE IN MIND

PRODUCTION MACHINERY
GREENLEE BROS. & CO.
Since 1863 © 1978 Mason Avenue, ROCKFORD, ILL.

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS
DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS • COMMERCIAL CASTINGS

For more data circle No. 865 on Readers' Service Card.

September, 1961

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



how to improve your turning methods with SUNDSTRAND "ENGINEERED PRODUCTION"

The Sundstrand "Engineered Production" approach to your turning requirements guarantees you maximum productivity per dollar of machine investment.

Sundstrand engineers first evaluate your production requirements, then provide the machine and tooling that give you the most economical production possible. Initial investment, present and future work requirements, workhandling, floor-to-floor time, tooling requirements, and other factors all are taken into full consideration to assure you lowest possible cost per piecepart.

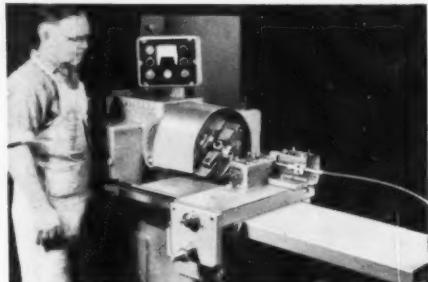
Often a standard Sundstrand automatic or tracer lathe is the best machine for the job. Or the greatest production efficiency may be secured by adding special tooling, automatic loading, special cycling controls, or other accessories to standard machines. Where production warrants, completely special machines may be the most economical answer.

To discover the opportunities for more production profits in your shop, ask us about a Sundstrand "Engineered Production" analysis of your turning operations.

1 SMALL-LOT TURNING



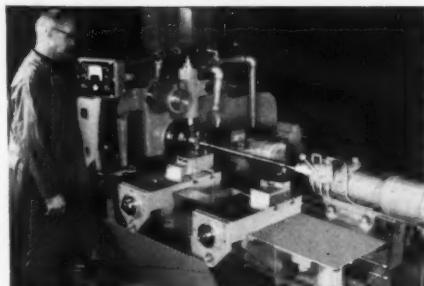
Multiple surfaces on various sizes and types of valve bodies are machined in a single automatic cycle on this Sundstrand lathe. Front slide tools feed longitudinally to bore and chamfer four ID's, turn and chamfer the OD, then cross-feed to groove and face one end. Average production is 100 pieces per hour. Simple cycle control provides quick cycle set-up and easy change-over for a wide range of parts.



2 LONG-RUN TURNING



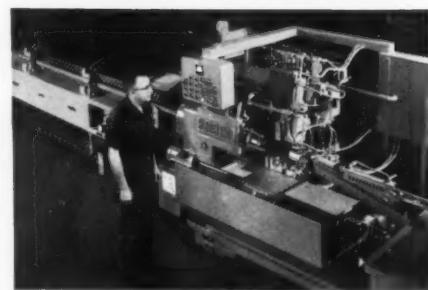
Special arrangement of multiple tooling and a long bed are features of this Sundstrand lathe for simultaneously machining both ends of automobile axle shafts in long runs. Tools on two front slides turn opposite ends; an overhead tool turns the OD of hub; while the cross-feeding rear slide tools face and chamfer both sides and the OD of flange. Production is 100 pieces per hour.



3 SPECIAL TURNING



Various small motor shafts are turned at an average rate of 450 per hour on this Sundstrand lathe. Bar stock is fed through the spindle, cut to length, turned, grooved, and ejected — all in one automatic cycle. Use of multiple tools reduces machining time — Additionally, these tools are equipped with micrometer-adjustable tool blocks and stops to minimize machine down-time for change-overs.



SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS

Division of SUNDSTRAND CORPORATION

To learn how Sundstrand "Engineered Production" can improve your turning methods send for Bulletin 631-2 today.



September, 1961

For more data circle No. 866 on Readers' Service Card.

MACHINES DESIGNED TO MEET YOUR NEEDS

ROCKFORD, ILLINOIS, U.S.A.



New "Swing Pinion Cone" concept basic in Gleason No. 503 Hypoid Lapper

SPC is a completely new concept in the lapping of spiral bevel and hypoid gears. With this method, improved refinement of tooth surfaces is obtained, resulting in quieter, smoother-running gears.

SPC is accomplished on the No. 503 Hypoid Lapper by actually pivoting the pinion member in a horizontal plane about a point that is the approximate center of the tooth mesh. This motion, combined with a corresponding horizontal movement of the pinion member during the lapping cycle, moves the contact uniformly over the entire tooth surface to insure complete lapping.

Previously prolonged lapping has been a major problem. However, extended tests have conclusively proved "prolonged lapping" with SPC does not have a major effect on the tooth contact pattern or tooth shape. This feature removes the problem of decreasing the amount of pinion axial adjustment during assembly.

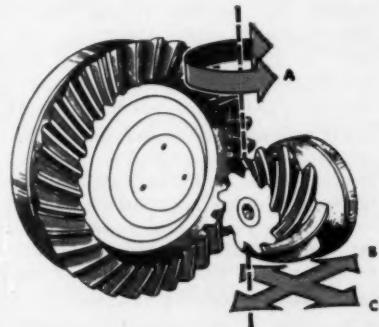
Completely Automatic Cycle. Once the correct lapping cycle is established, all of the motions are completely auto-

matic. Complete control of the lapping cycle, including such features as faster lapping time, independent lap of coast and drive side and proper backlash, are independently set through a convenient "dial-in" system.

Faster Production. An increase of approximately 20% productivity is obtained on the No. 503 Hypoid Lapper employing SPC.

The No. 503 Hypoid Lapper is a high production lapper, intended for automotive or custom gear shops, and accommodates 90° shaft angle gears up to 10" in diameter. The No. 504 Hypoid Lapper, our larger model, will handle gears up to 36" in diameter. Shaft angles on this machine can be extended to a 10°-160° range.

For more information and specifications, please write for technical bulletins.

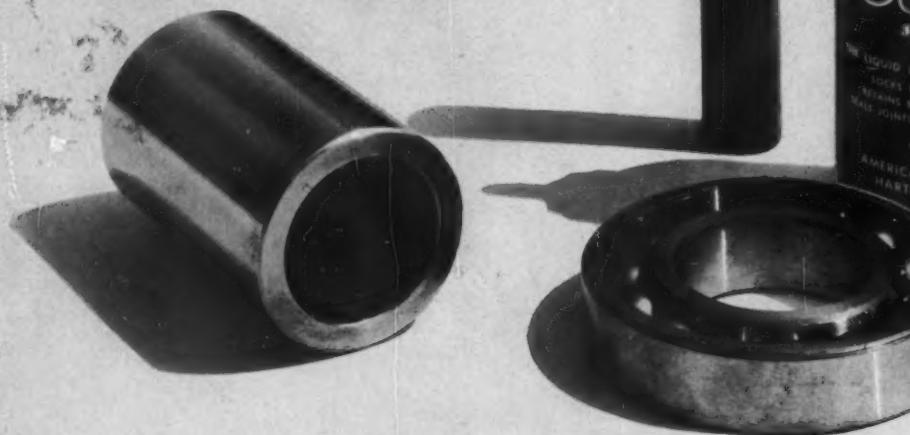


SPC LAPPING MOTIONS: The swing motion of the pinion head (A) moves the bearing along the length of the tooth. The axial motion of the pinion head (B) moves the bearing up and down the tooth profile, while the motion of the pinion head in the direction of the gear axis (C) maintains constant backlash.

GLEASON WORKS
1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

LOCTITE GIVES YOU THE IMPOSSIBLE PERFECT FIT

Only a small percentage of the adjacent metal surfaces of a press or interference fit are actually in contact. Yet the security of the entire assembly depends on that small area of contact.



Rigid tolerances are specified, and extra machining operations are performed to increase the area of contact. Nevertheless, it has been impossible to mate two metal surfaces perfectly, one inside the other. The Perfect Fit, like Infinity and Perpetual Motion, has seemed to exist only in theory.

YET A FEW DROPS OF LOCTITE CAN NOW PROVIDE WHAT THE MOST EXPENSIVE OF MACHINING METHODS CANNOT.

LOCTITE Sealant is a penetrating liquid resin that by capillary action is drawn into all the voids in a press or interference fit, filling them completely. Once there, LOCTITE hardens automatically into a tough, solid, load-bearing plastic film, capable of supporting loads in excess of 25,000 pounds per square inch, thus providing *A PERFECT FIT* of adjacent surfaces.

FACTS ABOUT LOCTITE SEALANT:

- LOCTITE is easy to use. It requires no mixing or heating.
- LOCTITE is 100% active. It totally fills the voids in press fits and threaded assemblies.

- LOCTITE contains no solvents—requires no solvents. There is no hardening shrinkage due to solvent evaporation.

- LOCTITE requires no expensive equipment. The bottle is the applicator; or mass application procedures can easily be set up with "around-the-shop" parts and materials.

- LOCTITE will withstand temperatures up to 300°F. LOCTITE Sealant makes a slip fit as strong as a press fit, a press fit stronger. It can be used to relax tolerances and to improve reliability.

Wherever metals are LOCKED—RETAINED—SEALED there is an opportunity to cut costs and increase profits with LOCTITE. Details on your application bring immediate response from our Application Engineering Department. Write today.



LOCTITE[®] SEALANT

AMERICAN SEALANTS COMPANY
207 North Mountain Road • Hartford 11, Connecticut



Do You TIPTOE THROUGH THE TOOLING?

"Packaged setup" . . . a new tooling concept by Scully-Jones . . . practically eliminates downtime for conventional time-consuming setups and tool changes that control economic lot size. Downtime for change-over of automatic chuckers can be cut 50 to 75%. Consider a conventional rerun requiring 2 or 3 hours for setup. With Quick-Set tooling, you can change over and cut the first piece in 30 minutes. The complete "package" includes installing chuck jaws, changing gears, setting trip dogs, inserting preset tools (**ONLY 2½ MINUTES**) and running the first piece. This means it is now economical to use mass-production techniques on short runs. Turret lathe jobs fit automatics. What is the profit significance to you? Parts inventory costs the average company from 18 to 25% per year. By transferring short runs to automatics and reducing lead time, thousands of dollars can be saved in inventory costs. For chuckers, multiple-spindle automatics, and almost any other machine tool, your S-J representative can provide Quick-Change, Quick-Set Tooling.

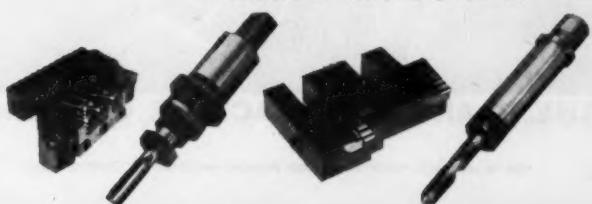
Scully-Jones and Company

1906 South Rockwell Street, Chicago 8, Illinois

**SCULLY
JONES**

**QUICK-CHANGE
QUICK-SET TOOLING**

Tools can be inserted in only two and one-half minutes.



What does "Blanchard Ground" mean? Well, a glance at this sample case would show that it means finishes as fine as 2 microns. And a quick check with the optical flat below would show flatness to within 1 light band. What's more, Blanchards provide high precision, high production grinding of materials ranging from glass and stone, thru gems and plastics, as well as ferrous and non-ferrous metals. Equally efficient at hogging, too. Send for "The Art of Blanchard Surface Grinding" and get the whole story.

BLANCHARD GROUND

2MU

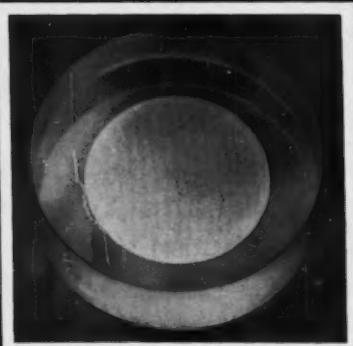
4MU

8MU

30MU

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PUT IT ON THE BLANCHARD



THE BLANCHARD MACHINE COMPANY 64 State Street, Cambridge 39, Massachusetts

in design or modernization of small-horsepower machines...

Fawick small clutch applications increase profit and production

... through low unit cost

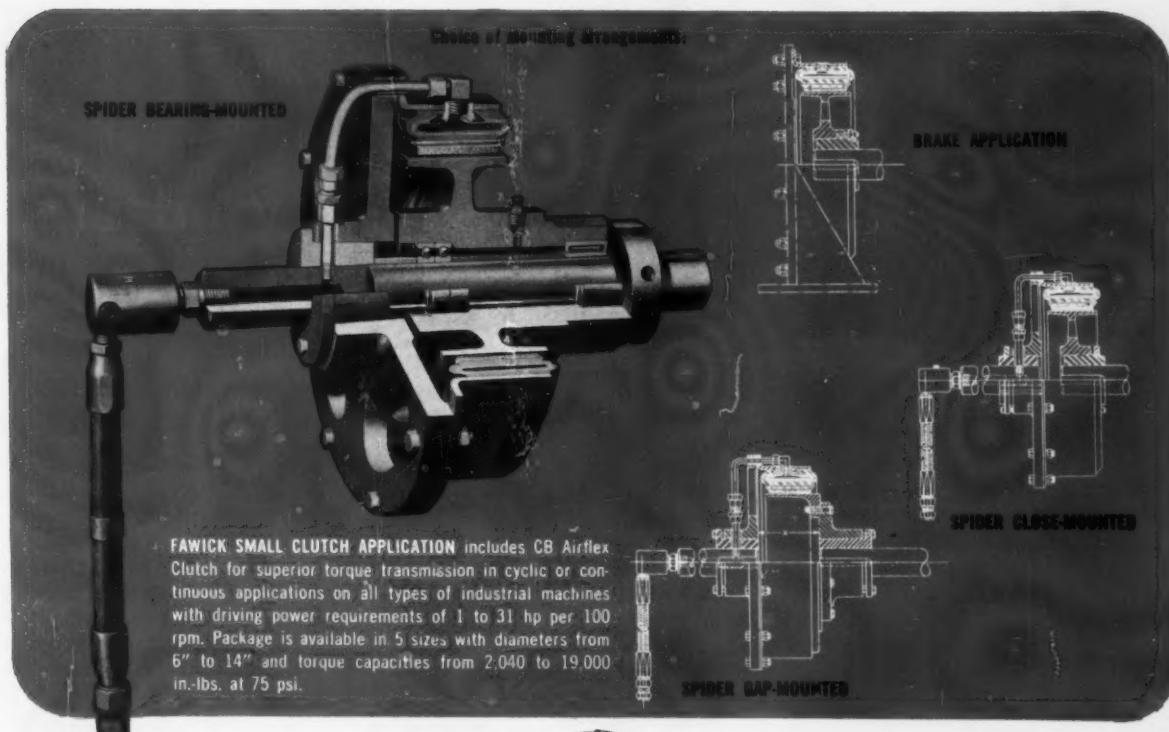
FAWICK Small Clutch Applications are standardized air clutch packages, produced in volume, and priced low for economical design or modernization of cyclic machines with small horsepower requirements.

... low installation cost

Complete FAWICK adaptability, with standardized bores and mountings, assures simplified installation in through-shaft, clutch-coupling and brake applications.

... and improved machine performance

FAWICK Small Clutches incorporate all the operating advantages of Fawick drum-type air clutches—instant engagement, overload protection, adaptability to local or remote control, automatic self-adjustment for wear and low maintenance. These permit faster machine cycling, greater precision, higher productivity.



For complete information on the advantages of power transmission by Fawick, call your nearest Fawick representative or write the Home Office.

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON ROAD • CLEVELAND 11, OHIO
Fawick Canada, Ltd., 60 Front St., West, Toronto, Ont., Canada

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel—the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.



213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS



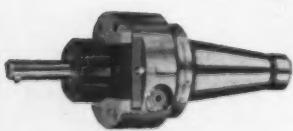
Floating Chuck



Standard Collet Chuck



Mikro-Lok Boring Bar



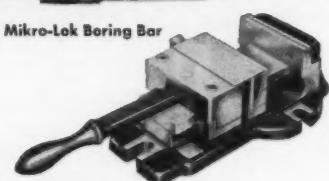
Boring Chuck



"Kwik-Switch"
Tool Holder



Standard Drill Bushing



Wedge-Lock
Production Vise

UNIVERSAL ENGINEERING COMPANY,

FRANKENMUTH 2, MICHIGAN

DATA

5 units with 5 spindles
24-inch index table
6 work fixtures
80-inch base
165 parts per hour gross

Kingsbury machine performs all the operations on the HOLE IN ONE chucking

Operator loads stainless steel "irons" of any shape at random

We used a similar headline in a 1931 ad and couldn't resist using it again. In thirty years our machines have changed a lot. But the basic principle is still the same: Combine operations in one chucking for lower unit costs and closer tolerances.

You could probably build your own machine for a simple job like this. It might cost you less. But you might also sacrifice accuracy and reliability.

On this job both the concentricity and diameter of the tapered hole are critical. If the hole were not concentric with the O.D. of the stem, the head would not align with the shaft of the club. So the spindles and work fixtures are in perfect relationship.

The hole diameter is also critical because its taper is so shallow. If the diameter were only .003 oversize, the shaft would go $\frac{1}{2}$ -inch too far into the hole and the club would be too short. So we hold the depth of taper exactly.

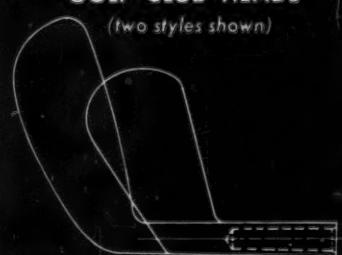
Even on much tougher jobs, Kingsbury machines turn out good parts hour after hour, month after month. That's because of good basic design and accurate, rugged construction. We run off test samples for your approval before shipment.

To save money in drilling type operations, ask us for a proposal. Kingsbury Machine Tool Corporation, Keene, New Hampshire.

FORGED STAINLESS STEEL

GOLF CLUB HEADS

(two styles shown)



Vertical Unit with Milling Head

1—MILL OFF THE STEM END

Four Horizontal Units

2—DRILL HALF DEPTH

3—DRILL FULL DEPTH AND CHAMFER

4—ROUGH TAPER REAM

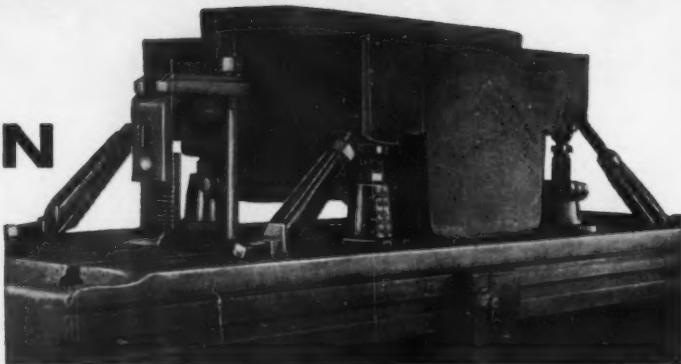
5—FINISH TAPER REAM

6—LOAD AND UNLOAD

KINGSBURY

ARMSTRONG

SET-UP and HOLD-DOWN TOOLS



ARMSTRONG PLANER JACK ARMSTRONG BRACING JACK ARMSTRONG VERTICAL JACK ARMSTRONG ADJUSTABLE STEP BLOCK



ARMSTRONG "T" SLOT BOLT

ARMSTRONG "T" SLOT NUTS

ARMSTRONG NUTS

ARMSTRONG WASHERS

ARMSTRONG UNIVERSAL
ADJUSTABLE CLAMP



ARMSTRONG
SET-UP WEDGES

ARMSTRONG
"T" SLOT CLAMP



ARMSTRONG
PLAIN CLAMP

ARMSTRONG
SCREW HEEL
CLAMP

ARMSTRONG
GOOSE NECK
CLAMP



ARMSTRONG
DOUBLE FINGER
CLAMP



ARMSTRONG
FINGER CLAMP

ARMSTRONG
"U" CLAMP

Whatever its shape, a work piece can be quickly, easily and safely set up on any T-slotted table with ARMSTRONG Set-up Tools. Comprising a complete "system" of supporting and holding devices in all essential sizes, ARMSTRONG Set-up Tools usually pay for themselves on the first job and continue to lower costs for years to come.

Save Time: Keep costly machines and high priced men producing—save time otherwise lost while operators rummage in the scrap box for materials with which to devise makeshift set-up methods.

Prevent Breakage and Spoilage—correctly designed, machined from special steels or drop forged and heat treated, they are extremely stiff, strong and reliable.

Increase Accuracy—hold work rigidly and support it fully regardless of shape.

Prevent Accidents—end risk of set-up failure with resulting tool breakage, damage or personal injury.

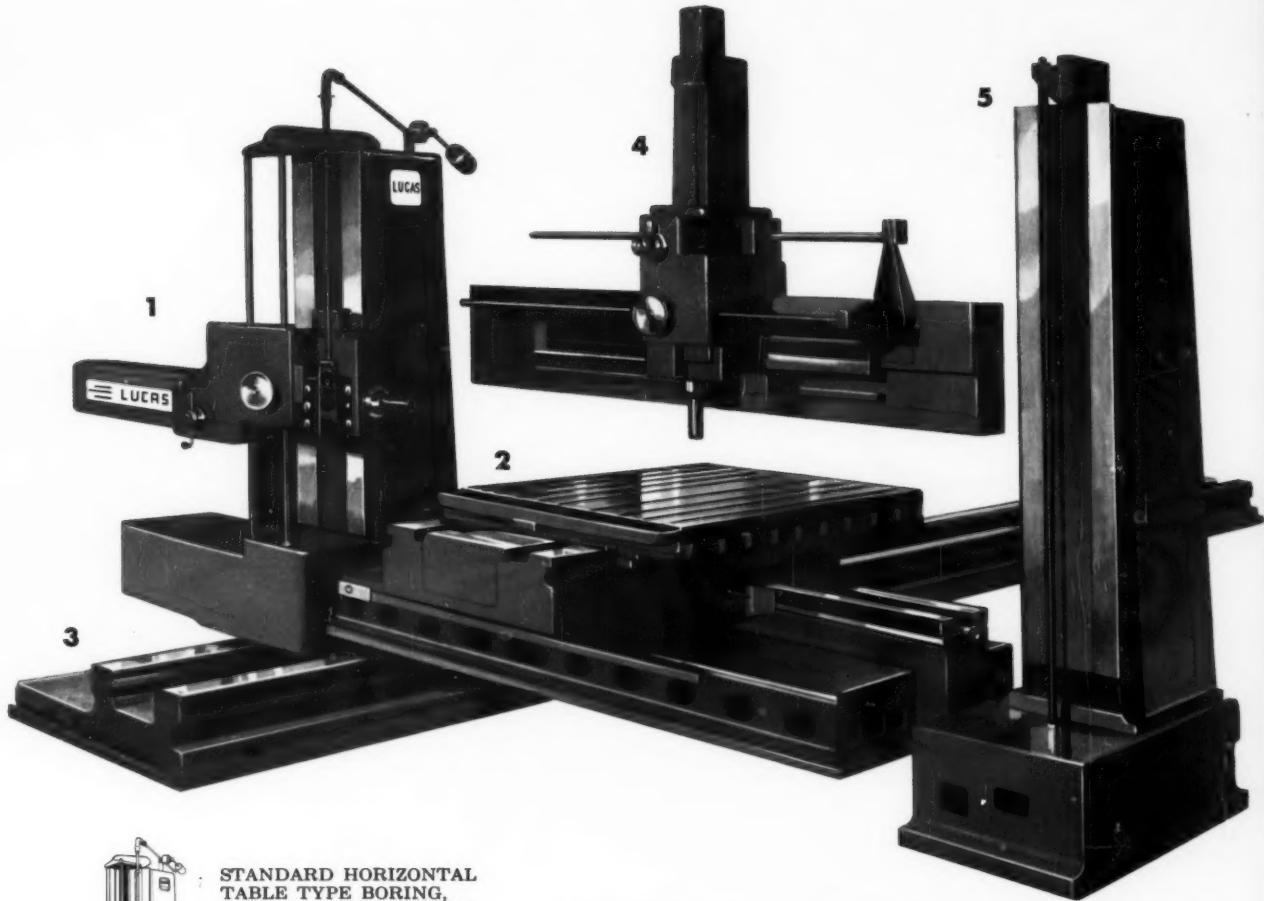
Increase Profits—by reducing down time, increasing man hour output, assuring accuracy, ARMSTRONG Set-up and Hold-down Tools cut costs and build profits. They are part of every properly equipped tool room and shop.

Your Local Armstrong Industrial Distributor carries a good stock of Set-up and Hold-down Tools. He offers you quick, efficient service on these, as well as other, quality ARMSTRONG Tools.

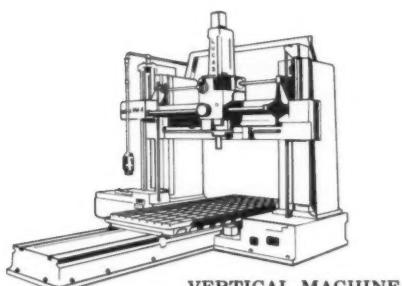
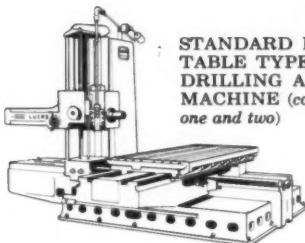


ARMSTRONG BROS. TOOL CO.

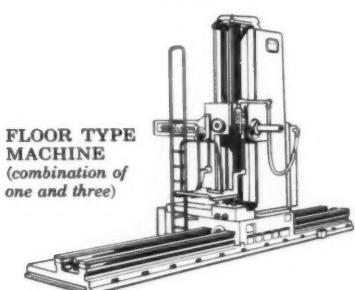
5213 W. ARMSTRONG AVE. • CHICAGO 46, ILL.



**STANDARD HORIZONTAL TABLE TYPE BORING,
DRILLING AND MILLING
MACHINE (combination of
one and two)**



**VERTICAL MACHINE
(combination of one, four
and five)**



**FLOOR TYPE
MACHINE
(combination of
one and three)**

Versatility of Design?

LUCAS

Each Lucas machine—table type, floor type, or vertical—is, in effect, a composite of basic precision-made components, *with integrally cast beds*, assembled to meet your specific requirements. This progressive building-block approach to boring, drilling and milling machine design results in (1) the widest range of field-tested machine models, (2) the same high standards of performance regardless of which type machine you specify, (3) the widest possible range of work with the least number of extra gimmicks and gadgets for so-called "special" jobs. When you want the best that your machine tool dollar can buy, talk to the people who pioneered in the development of the horizontal boring, drilling and milling machine. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Ave., Cleveland, Ohio.

NOTE: In order to better define the basic components, we have shown main bed castings separated. In actuality, all bed castings are massive integrally cast units providing maximum rigidity for highest precision.

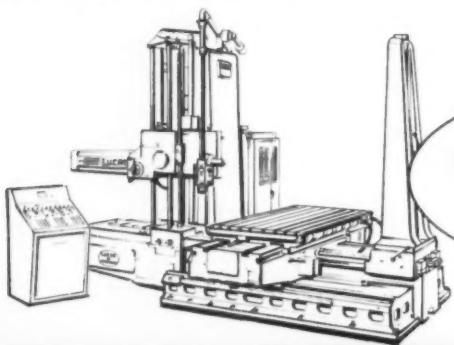
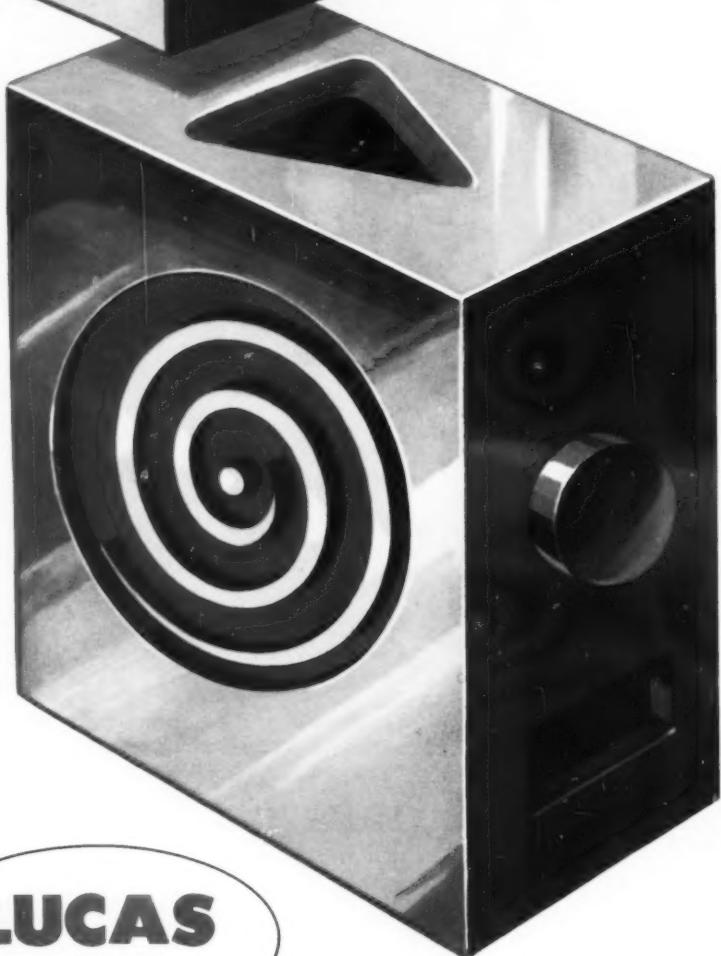
LUCAS
PRECISION



Tape Control? **LUCAS**

By offering the widest range of precision table type and floor type boring, drilling and milling equipment . . . by being able to perform the widest range of point-to-point and contouring work . . . by closely coordinating our efforts with the leading producers of numerical controls, Lucas is better able to provide the numerically controlled boring, drilling and milling machines you require.

No longer something to read about and think about, good tape controlled equipment is working hard in more and more plants to provide the competitive edge that spells the difference between profit and loss. A numerically controlled Lucas can help you now to cut lead time in the form of direct and indirect labor, reduce inventory, greatly reduce or eliminate jigs and fixtures, eliminate human error, etc. The list is a long one and your Lucas representative is the man who can spell it out book, chapter and verse. Review your requirements with him for a knowledgeable proposal for a numerically controlled Lucas to fit your specific needs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio.

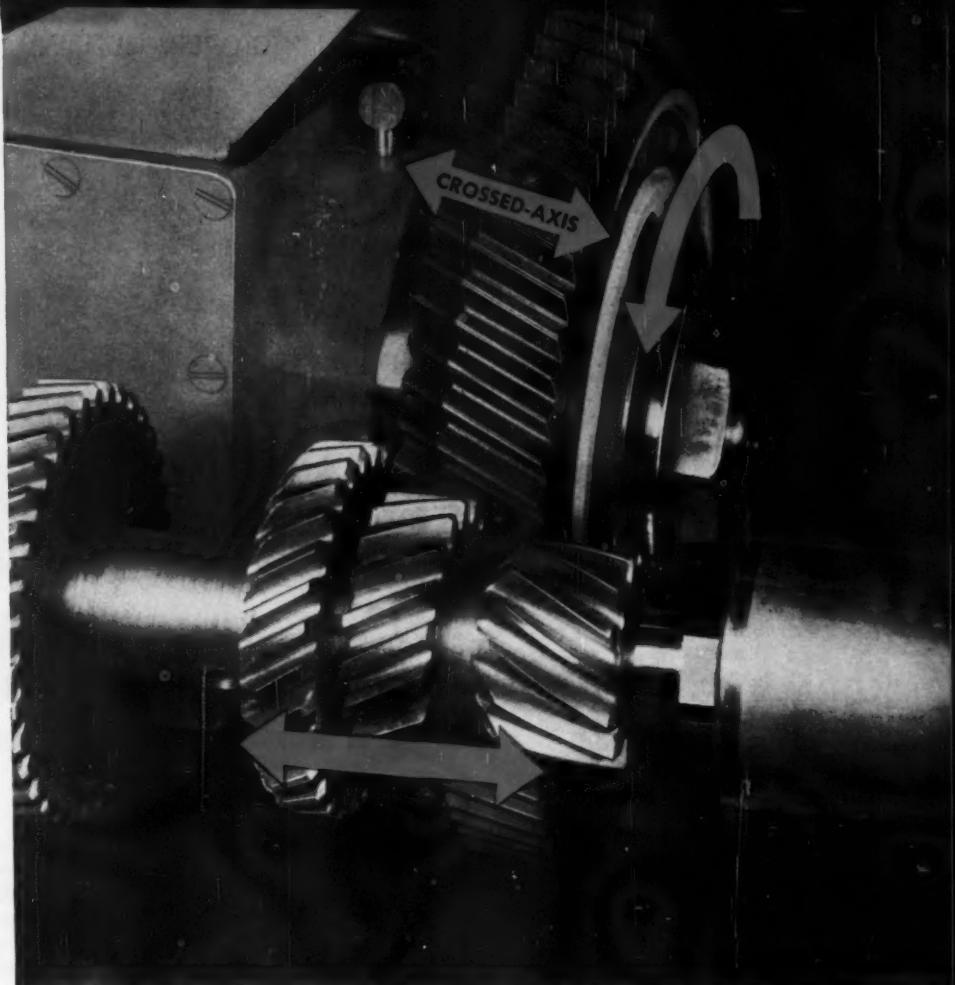


LUCAS
PRECISION

NEW



FOUR-MOTION GEAR FINISHING PROCESS GIVES...



TRUE HONING ACTION!



Smooth hone may be used to finish OD's in certain applications.

The new Michigan 999-A Abrasive Hard Gear Finisher uses four separate but integrated motions to give better surface finish on hardened gears and cylindrical parts. Nicks, burrs, some errors in lead and runout, involute, etc. are quickly corrected with newly developed hones of high-strength plastic available in a wide range of abrasives.

The hone (1) oscillates axially at high speed while (2) the work is reciprocated across the hone, (3) the gear is rotated—under controlled pressure—in mesh with the hone causing (4) sliding action due to crossed-axis of work and hone. This "Four-Motion" process results in smoother, quieter running parts.

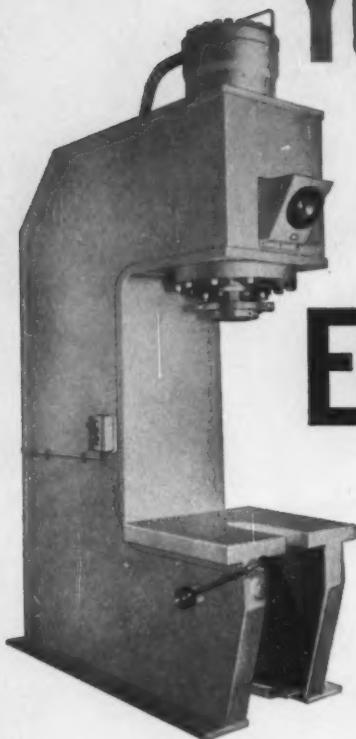
Independently variable speeds and up to 25° hone head swivel will accommodate a wide variety of workpieces. Crown-taper attachment, automatic loader, internal gear attachment and tool dresser are available as optional equipment. For full details write for Bulletin 999-A.

A head modification kit to convert Michigan Model 999 to the new process is available.



MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN

WANT TO SPEED FORMING OPERATIONS?



You specify the shapes... **ERIE WILL BUILD THE PRESS**

When you have unusually shaped parts to position for assembling, forming, forcing, straightening and similar operations, an Erie C-frame hydraulic press may be the all-purpose machine you need. Open on three sides, the C-frame design provides maximum accessibility to the work area. It eliminates the restrictive caging normally caused by support rods or frame castings.

Custom-designed Erie C-frame hydraulic presses can be manufactured to meet unusual requirements. Both horizontal and vertical frame machines have been built for high-speed production in capacities to 500 tons.

Standard Erie C-frame hydraulic presses are also available in a range of sizes, with capacities up to 250 tons.

Erie C-frame hydraulic presses have all steel welded frames to assure a high safety factor with minimum deflection. Power units are built in. Sensitive controls include dual hand and foot levers to provide accurate operation in either direction.

For the complete story, phone or write Mr. Carl Hammon, Erie Foundry Company, Erie 1, Pa. Ask for Bulletin 370.



**ERIE FOUNDRY
COMPANY**

ONE OF THE GREAT NAMES
IN FORGING SINCE 1895

EP-60-04

Manufacturers of Forging Hammers • Forging Presses • Hydraulic Presses • Trimming Presses

J-8083

Cost-Cutting-

A SIMPLE
MATTER OF
SELECTION



59-15



COUNTERBORE SETS

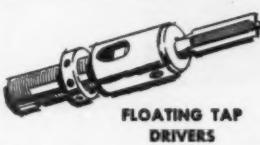


INVERTED SPOT FACERS



COUNTERBORES—

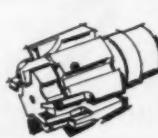
COUNTER SINKS,
HOLDERS, PILOTS



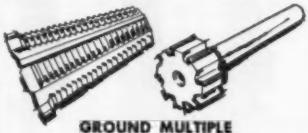
FLOATING TAP
DRIVERS



INSERTED
BLADE
FACE MILLS



MULTIPLE
DIAMETER
BORING
CUTTERS



GROUND MULTIPLE
THREAD MILLING CUTTERS



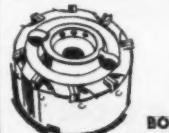
GROUND AND UNGROUND
FORM-RELIEVED CUTTERS



SINGLE-POINT
CARBIDE TIPPED TOOLS



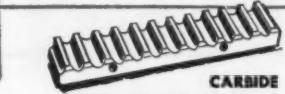
MULTIPLE STEP
BORE REAMERS



CARBIDE
TIPPED
CYLINDER
BORING CUTTERS



DOVETAIL
FORM TOOLS



CARBIDE
TIPPED
BROACH
SECTIONS



INVOLUTE SPLINE
SHELL TYPE BROACHES

Every standard and special tool is of but one quality—the finest available. Since 1921, Continental has specialized in cost-saving cutting tools (just a few of which are shown at left), producing design innovations in hardened, high-speed tool steel, carbide and special-alloy cutting materials.

Available in the types and sizes required to do the complete job from rough to finish, Continental Cutting Tools are job-tested in the toughest proving ground—Ex-Cell-O's own machine tool and precision parts production lines. As a result, they come to you ready to increase the output of even your best machines!

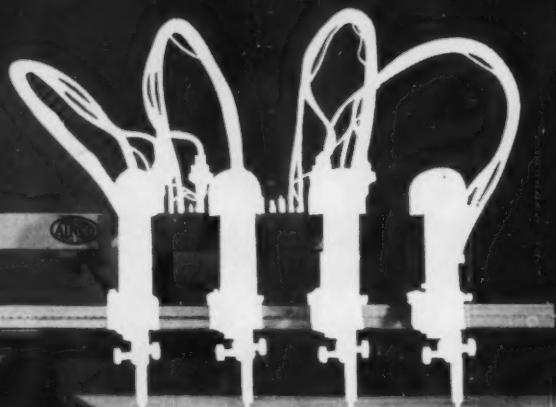
Continental engineers will be glad to work with you in selecting the correct CTW Cutting Tool for long life and maximum performance. See your local Ex-Cell-O Representative, or write direct to Continental Tool Works Division for full details. In Canada, contact your local Ex-Cell-O Sales Associates Representative or write direct to Colonial Tool Co., Ltd., Windsor.

Continental **TOOL**
WORKS

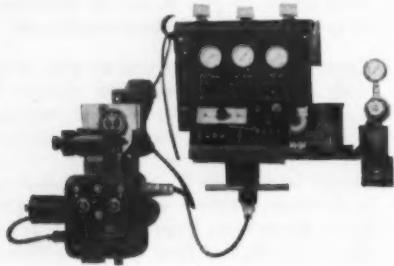
DIVISION OF

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

WHEN YOU CUT MILL PLATE—



**AIRCO'S NATURAL GAS
FLAME CUTTING SYSTEM
OFFERS EVERYTHING YOU NEED**



Above: new Airco Linagraph. Airco produces every type of flame cutter — from portables to advanced large automated systems.



Cutting bull gear blanks, ship plates, hangers, machine frames, or any other shape?

Equip with an Airco natural gas flame cutting system. You'll cut at lower cost. You'll reduce warpage. You'll cut so precisely that most pieces need no finishing. Moreover, the Airco system will work even when gas service pressure is low.

Main reasons why:

(1) Only Airco natural gas flame cutting systems are built from a component line that is complete and matched. Exact needs are met.

(2) Multi-torch Airco machines are based on the exclusive pantograph design. Tracing head moves only torches

and gas system; carriage is driven independently. No extra burden here.

Airco makes everything you need for your natural gas flame cutting operation. Call Airco—where the big idea is teamed with unexcelled research and experience.



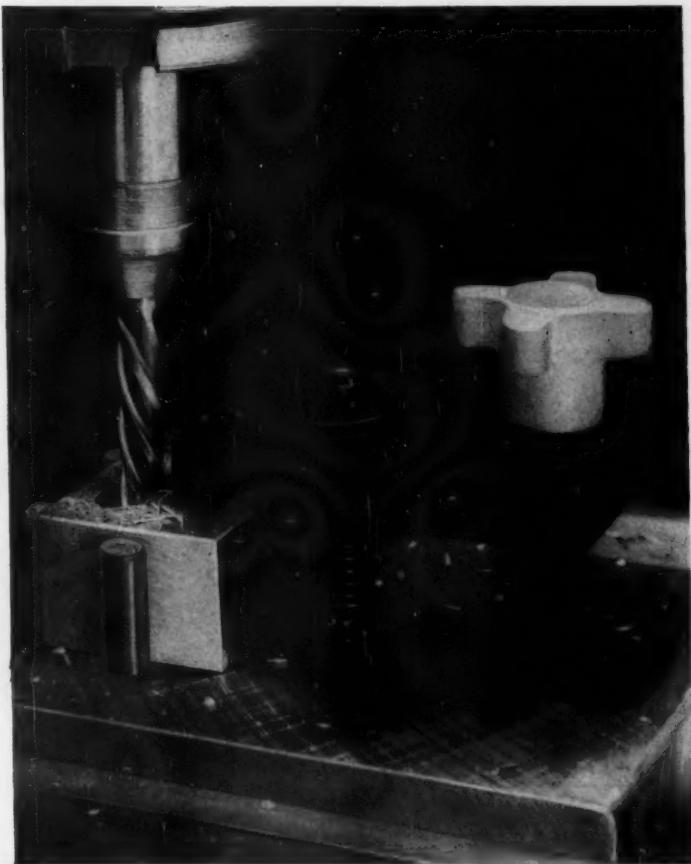
**AIR REDUCTION
SALES COMPANY**

A division of Air Reduction Company, Incorporated
150 East 42nd Street • New York 17, N. Y.

More than 700 Authorized Airco Distributors Coast to Coast

NOW A Complete line of Jig & Fixture time-savers!

Ex-Cell-O Precision Clamp Assemblies and Standard Details for Fast, Economical Fabrication of Jigs and Fixtures



COMPONENTS FOR ALL YOUR JIG & FIXTURE NEEDS—AVAILABLE IMMEDIATELY FROM A SINGLE, RELIABLE SOURCE!



Micron Sections
Machined cast-iron shapes cut to order.

Drill Jig Bushings
Carbide or steel for metal and plastic jigs.



Lift-Swing Fixtures For fast drilling of difficult holes.

Reader service card number is for Fixture Components only; please request literature on other items separately.

Ex-Cell-O's new line of clamp assemblies, fixture details, spring plungers, torque screws and other fixture components gives you an unusually wide range of standard clamps and details in sizes and types to suit virtually every fixture-building need.

The complete cataloged line—from clamps and locks to plungers, locating buttons, hand-wheels and torque screws—is available from your local Ex-Cell-O Representative or Distributor, or direct from Ex-Cell-O. Phone TOwnsend 8-3900; TWX-DE 876; Wire ZTC.

BUYER'S GUIDE and PRICE LIST—Ex-Cell-O's new Fixture Component Catalog lists hundreds of parts and assemblies, specifications and prices. No cost or obligation. Send for it today!

61-208U

EX-CELL-O FOR PRECISION

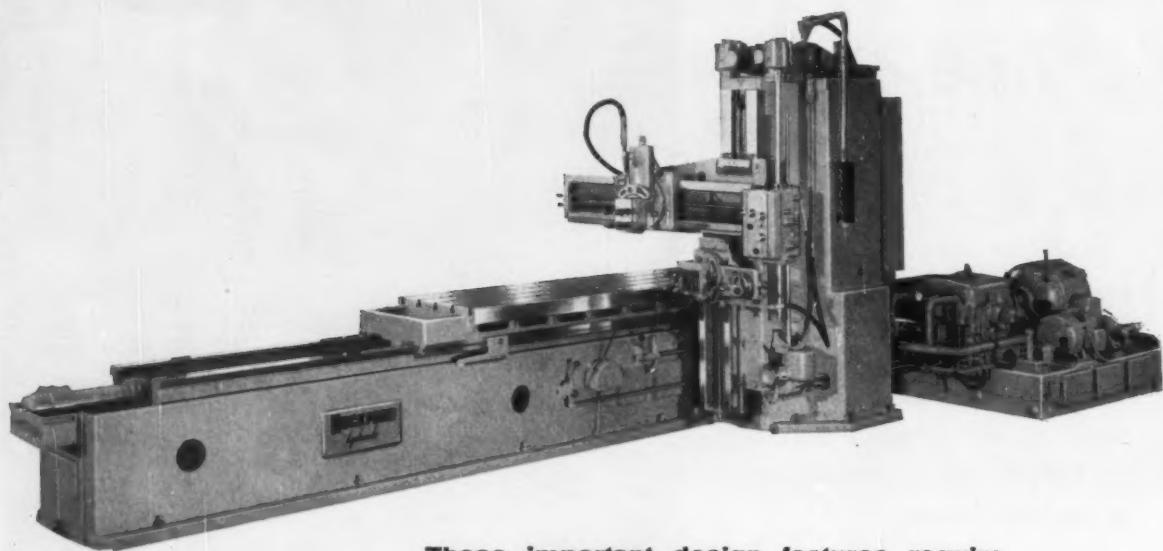
PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAUGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Bushing Sales Division

EX-CELL-O
CORPORATION
DETROIT 28, MICHIGAN

A little maintenance goes a long way!

... on **RMT** SHAPER-PLANERS



These important design features require almost no attention:

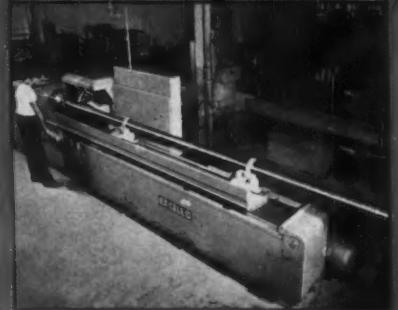
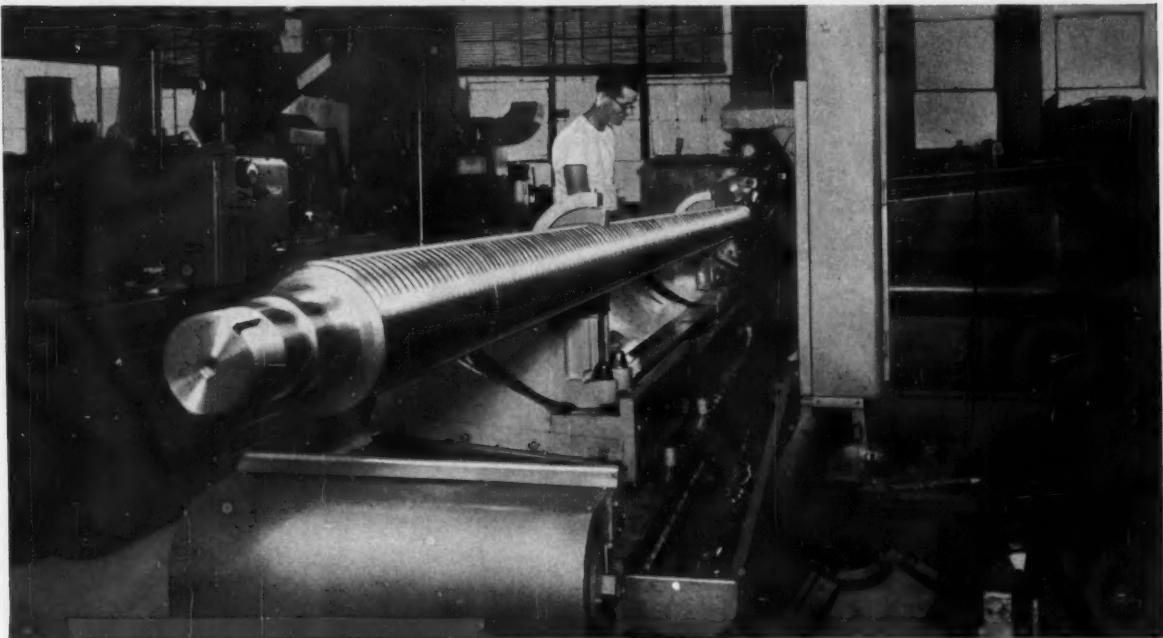
- Table stays on bedways — Dash-pot cylinders prevent overtravel and running off the bed.
- Few moving parts and automatic lubrication are inherent features of hydraulic drive.
- Positive mechanical reversals — table-dogs actuate pilot valve for table reversals, feed, and tool lifters — no electrical contactors to wear or fail.

Maintenance is an important factor to consider in any contemplated capital investment. You will certainly want to compare these features with new or present equipment!

For complete information, write RMT Co. — or contact your nearest RMT representative.

ROCKFORD MACHINE TOOL CO. ROCKFORD, ILLINOIS

FAST DELIVERY of Lead Screws and Threaded Parts!



The lead screw shown above in a Model 120 Ex-Cell-O Thread Grinder is 19 feet long, 5 inches in diameter. Guaranteed tolerance is $\pm .0002$ " per inch, $\pm .0005$ " per foot, non-accumulative.

- All thread forms
- Any size, any quantity
- Regular, worm or ball-race
- Guaranteed accuracy

Ex-Cell-O can quickly deliver custom lead screws and threaded parts in any quantity, in any size from miniature to twice the length of the 19-foot screw illustrated. Thread types include worm, ball-race, Acme, Modified Acme, Buttress, Whitworth and others in all classes, I.D. and O.D.

The Ex-Cell-Ability to design, develop and produce precision parts to your specifications is amply supported by modern quality control, heat treatment, machining and inspection methods and fast service. For a prompt quotation, contact our Representative nearest you, or send us your prints.

61-311

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL/JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Precision Parts Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

STEELWELD SHEAR WORKS 3400 HOURS A YEAR

"Serves Art Iron, Toledo" for Over 10 Years



This shear provides sharp straight, accurate cuts every stroke. Here it is cutting a $\frac{3}{4}$ inch steel plate.

All shearing at the Art Iron & Wire Works, Inc., a 200-employee plant in Toledo, Ohio, is done on a Steelweld Pivoted-Blade Shear rated for $\frac{3}{4}$ " x 12'-0" mild steel. This is the only shear in the plant.

Art Iron manufactures ornamental iron and structural steel items to order and also has a large steel warehousing operation. An inventory of over 10,000 tons of steel of every kind, size and shape is maintained to serve any need. This work keeps the Steelweld busy cutting a great variety of steel items varying in thickness from 18 gauge to $\frac{3}{4}$ inch.

The Steelweld feature most valued by Art Iron is the knife-clearance adjustment. They know that to obtain the best cut with the least burr and distortion, it is essential to have the clearance set to suit the plate thickness. Because this adjustment is so easy and fast to make, their shear operators make it automatically as a part of the regular shearing routine.

Knife life is very satisfactory. This is attributed in large part to the shear operators consistently using the proper knife clearance. Despite the large tonnage of steel cut, the knives usually require regrounding only once in a period of four months or longer.

The Art Iron, Ft. Wayne, Indiana, plant also has a Steelweld Shear. Its purchase several years ago was influenced by the success with the machine in Toledo.



Prefabricated industrial buildings are among the many items made by Art Iron. These require a large number of plates for footings, gussets, splices, etc., all of which are sheared on the Steelweld.

Write for free copy of catalog No. 2011

STEELWELD
PIVOTED
BLADE
**Mechanical and Hydraulic
SHEARS**



Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5465 E. 282 ST. • WICKLIFFE, OHIO



Using basic components, seven different arrangements are possible, as shown above. Spindle drive motors can be mounted at right, left, or on both sides with single or double spindles; two machines can be placed side-by-side or used with other production machines.

The 4 BIG Features of Ex-Cell-O's New 411 Vertical Are Important To You

1. QUICK TOOL CHANGING—Tool changing and adjusting is fast and easy because of "clean" design and placement of the Model 411's components.

2. EASY PARTS HANDLING—Vertical construction lends itself to safe, easy loading and unloading of parts in a wide variety of shapes and sizes.

3. SINGLE COLUMN CONSTRUCTION—Solid base-column gives firm support to the hydraulically-operated compound tool slide. Rugged, simple

construction assures maximum accuracy and efficiency, plus long life with lowest maintenance.

4. PRODUCTION VERSATILITY—The all-new Model 411 performs turning, boring, racing, grooving, limited contouring and chamfering operations singly or in combination. Often, both sides of disc-type parts can be machined simultaneously.

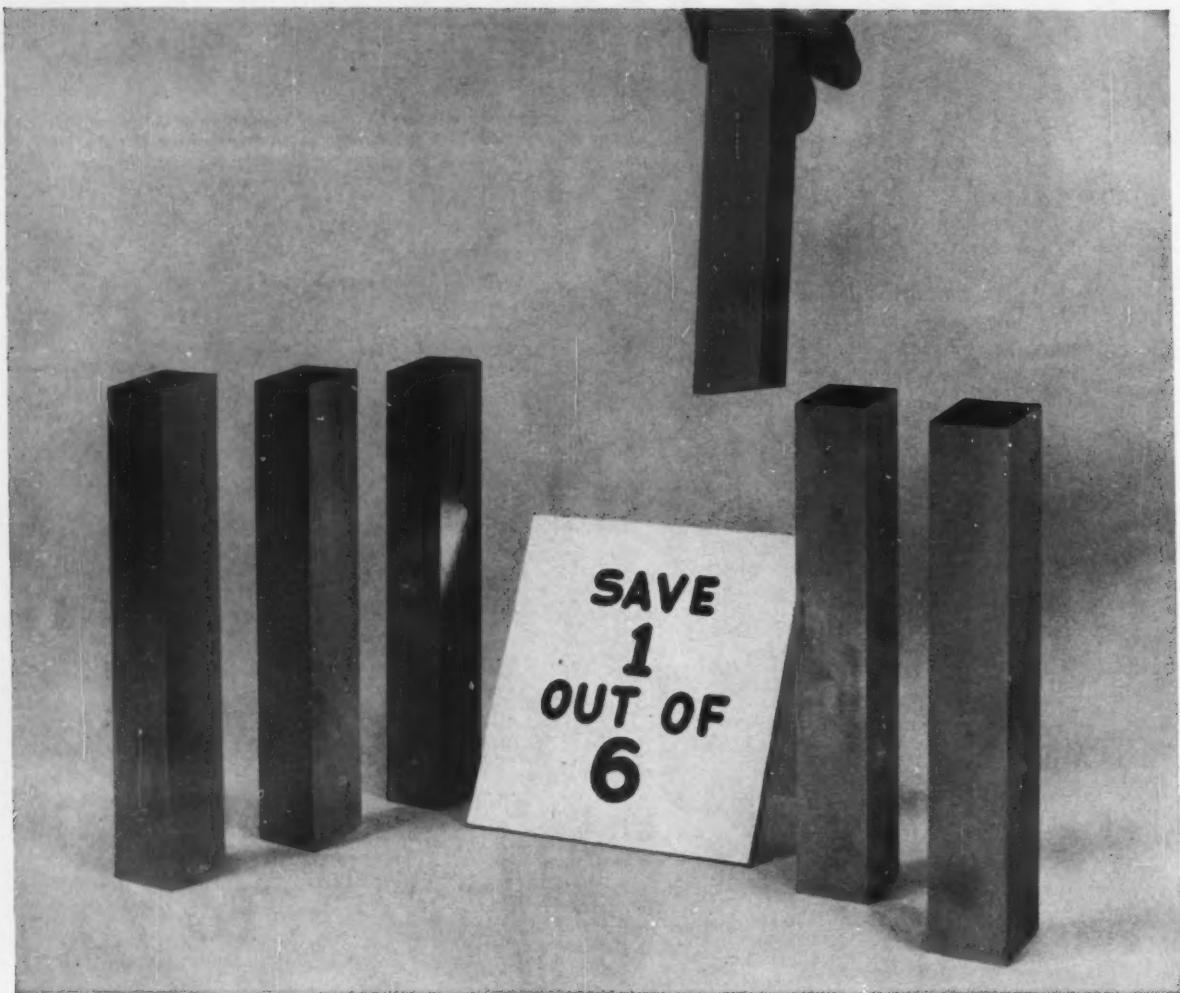
Contact your Ex-Cell-O Representative or write direct for details.

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN



INCREASE TOOL LIFE AS MUCH AS 20%

Read how a "Cleartex Cure" ends the cutting oil dilution problem forever . . . increases tool life . . . slashes per-piece production costs as much as 40%.

Lube oil may be leaking into your cutting oil sumps this very minute. Surveys show it happens in 70% of all automatics. This dilution will reduce tool life, increase downtime, and result in premature discarding of cutting oil.

How a "Cleartex Cure" works. A "Cleartex Cure" checks these losses right away . . . prolongs tool life as much as 20%. Here's why: Cleartex Oil—heart of a "Cleartex Cure"—is used in both cutting and lubricating sumps. Cutting oil strength is always full—regardless of leakage. Over-all savings can slash per-piece production costs as much as 40%. Versatile Cleartex is a hydraulic fluid, too. *In fact, it's the tri-purpose cutting oil.*

How to take a "Cleartex Cure." Getting the full benefit of a "Cleartex Cure" is easy. An experienced Texaco engineer will survey your automatic set-up. He'll tell you which machines will benefit from Cleartex. Our illustrated booklet, "Cleartex in Automatic Screw Machines," spells out the benefits of a "Cleartex Cure" in detail.

To get the booklet, plus the survey, contact the nearest of the more than 2,300 plants distributing Texaco Products, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Dept. MA-111

Tune In: Texaco Huntley-Brinkley Report, Mon. Through Fri.-NBC-TV

TEXACO
Throughout the United States
Canada • Latin America • West Africa

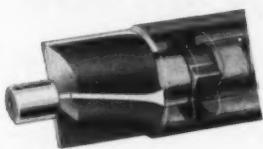
6 Features that make a big difference in counterboring operations!



1. HAND DETACHABLE . . . a twist of the wrist engages or releases the cutter after the severest cutting operation.



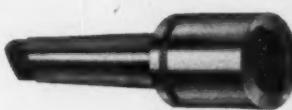
2. STURDY DRIVE . . . diametrically opposed drive lugs engage corresponding abutments in the holder.



3. EXTRA TORSIONAL RIGIDITY . . . drive lugs are close to seating shoulder of cutter for powerful, smooth operation.



4. BALANCED DRIVE . . . double bearings—one on each side of drive lug—provide extra rigidity.



5. FREE FROM OBSTRUCTIONS . . . holder body slips easily into a bushing or can be threaded for stop nuts or collars or fluted for lubrication.



6. PRACTICALLY INDESTRUCTIBLE . . . no binding, no shearing—driving forces apply compression.



These are the features that make the difference in counterbores—six reasons why no one reports failure of a Continental Counterbore Drive!

Continental

CTW

TOOL WORKS

DIVISION OF

EX-CELL-O

CORPORATION
DETROIT 32, MICHIGAN

60-43



He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy" . . . accuracy, being held to within a few thousandths of being perfectly straight, and he can actually see the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2" to 18" in diameter, this MARVEL #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective

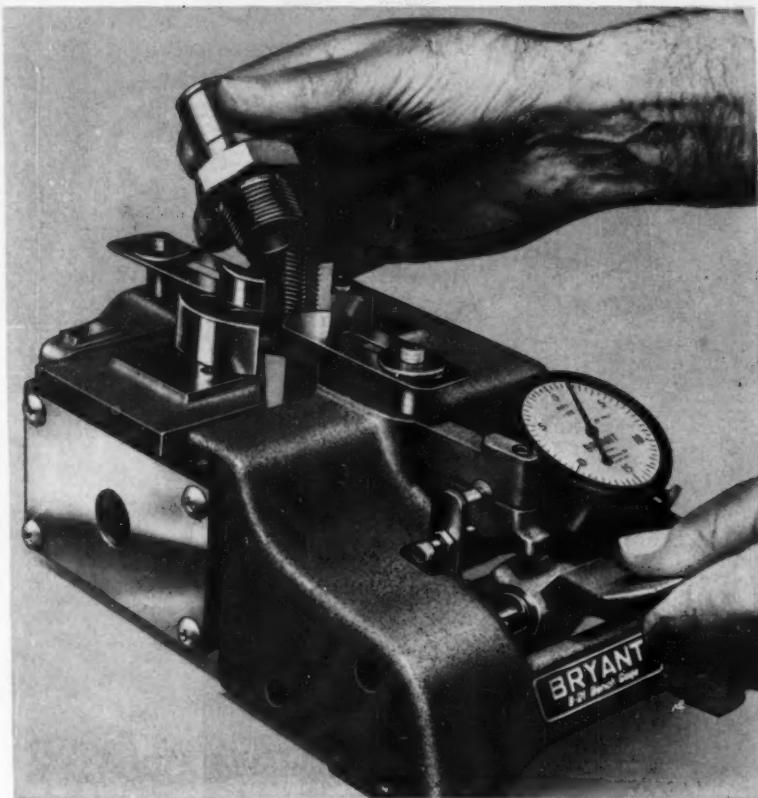
electro-mechanical servo-mechanism that continuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SURE-LINE" unit literally "steers" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SURE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Production Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. Write for catalog today.

ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL Metal Cutting
SAWS
Better Machines—Better Blades

Q. How many gages needed to make these thread and groove checks?



- OD "Go check"—size #0 to 5" dia.
- ID "Go check"—size #3-48 to #10-24*
- ID "Go check"—size #10-32 to 5" dia.
- ID "PD check"—size #6 to #8*
- ID "PD check"—size #10-24 to 5" dia.
- ID snap-ring, O-ring and special groove checks—size 0.239" to 10" dia.

*Spin-on

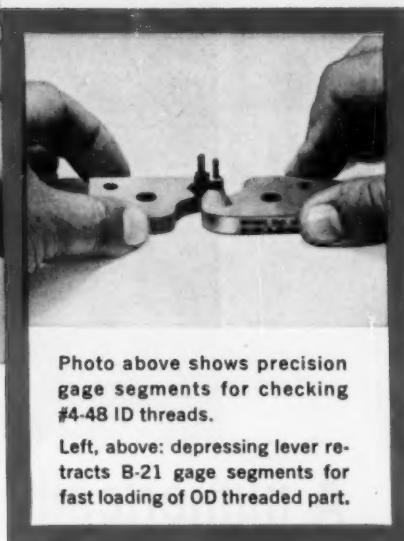


Photo above shows precision gage segments for checking #4-48 ID threads.

Left, above: depressing lever retracts B-21 gage segments for fast loading of OD threaded part.

A. One Bryant B-21 Bench Gage!

Using interchangeable gaging segments, the Bryant B-21 Precision Bench Gage quickly and accurately checks a wide range of bored, threaded and grooved parts. Add optional attachments and accessories as needed, and a single B-21 becomes a universal "inspection sta-

tion," ready to change in minutes from such jobs as checking squareness of face of parts from 2" to 7" OD, to checking bore concentricity!

See your Bryant Gage Representative, or write direct for prices, design details and application data.

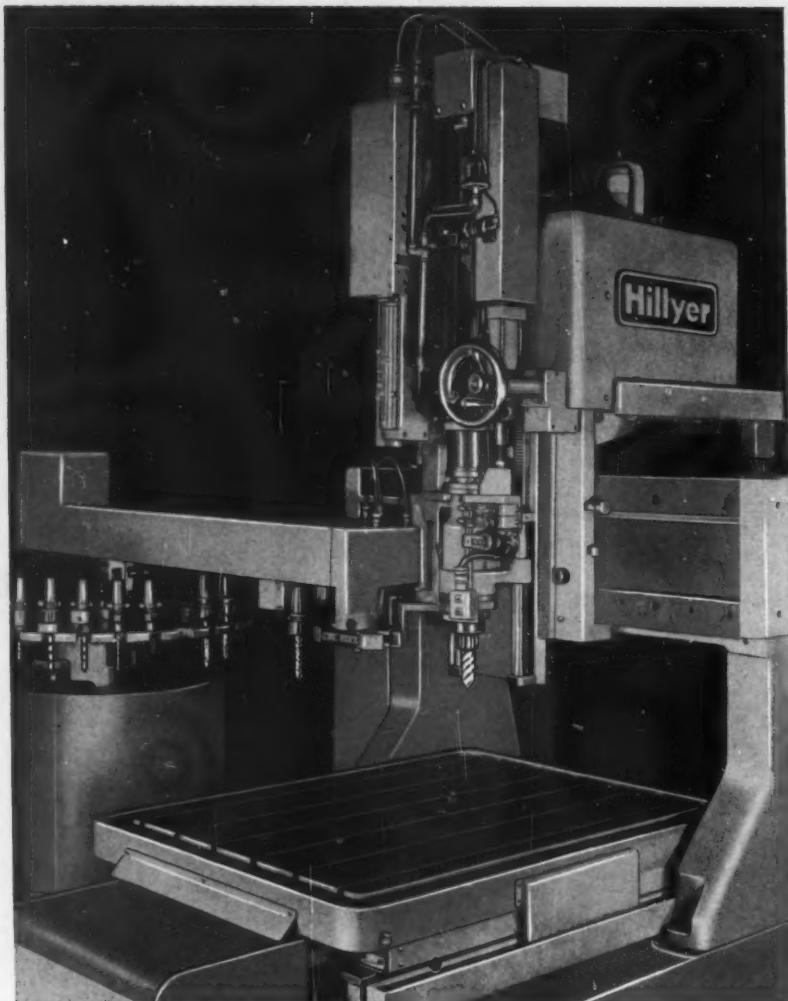
61-62B

EX-CELL-O FOR PRECISION

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EX-CELL-O
CORPORATION

Grenville Plant, 945 E. Sator St., Grenville, Ohio



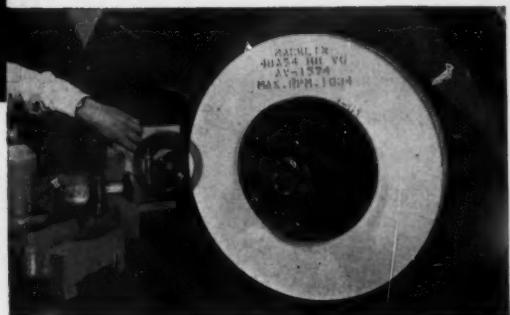
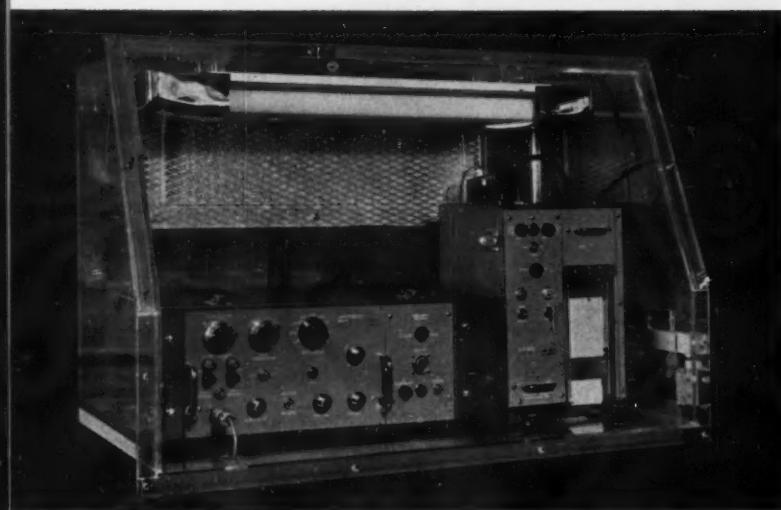
A numerically-controlled drilling machine with AUTOMATIC TOOL CHANGER

HILLYER'S NEW TAPE CONTROLLED DRILLING MACHINE WITH

AUTOMATIC TOOL CHANGER is substantially less than its closest competition — with features superior to them all! In addition to complete numerical control of all drilling, reaming, tapping and straight-line milling operations, the Model TC-36C automatically changes tools as designated by dial or tape. Any combination of spindle speed, feed rates, or depths can be selected at any time by dial or tape command. Any combination of these three variables can be selected at any time. And the machine permits a given tool to be programmed to varying levels and varying depths, all on the same work piece, all within a working range of 36" x 24". A total of 30 tools can be accommodated in the changer at any one time — yet tool changing takes just seconds! Write today for complete details to Dept. 321.

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CORPORATION
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A
Revolutionary
New Way
To Evaluate
Grinding Wheel
Hardness and
Uniformity
By Electronics



DYNA-GRADED®

Grinding Wheels by MACKLIN

*Developed under the direction of the
Macklin Research Department.*

On May 10, at the Production Engineers' Conference at the A.S.M.E. at Toronto, a paper was presented on a method of scientifically determining grinding wheel hardness and uniformity. It involves using the Dynamometer, illustrated above, to accurately determine wheel hardness and uniformity across the entire cutting face of the wheel under controlled rotating conditions which simulate actual grinding.

Here's How it Works . . .

Minute amounts of abrasive are crushed from the wheel's cutting surface by a conical, hardened steel wheel which is in running contact with the grinding wheel being tested. The force required to crush these minute amounts of abrasive and bond is electronically recorded on a permanent tape. Any significant variation in wheel uniformity or hardness is recorded on the tape. This means Dyna-Graded® wheel characteristics are precisely predetermined before the wheel is shipped. This means we can assure you more accurate wheel duplication, order after order. This means better cost control of your grinding operations.

For more than a year, Macklin has been Dyna-Grading wheels. Within a few months, Dyna-Graded wheels will be available for most of your high production grinding operations. Why settle for less? Put Dyna-Graded Macklin wheels to work protecting your production. For further information, contact your Macklin distributor or write us direct.



MACKLIN company Jackson, Michigan

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Dept. 14

New

RED RING MACHINE SHAVES LARGE GEARS FASTER... MORE EFFECTIVELY



Table in
shaving position

Table in
loading position

Significant design innovations in the New Model GCX enable you to shave the larger, heavier gears (up to 24" Pitch dia.) with the same facility and precision as smaller gears are shaved.

Methods of loading and unloading are unrestricted. The work is loaded with the table at the extreme limit of its travel—clear of any overhead interference.

At the end of the shaving cycle, the cutter head rises in rapid traverse to clear the work and the table returns to its loading station for quick unloading.

If you manufacture such gears as are used in trucks, agricultural or ordnance equipment, ask for Bulletin S60-8 and get the full details of this new, economical method of gear shaving.

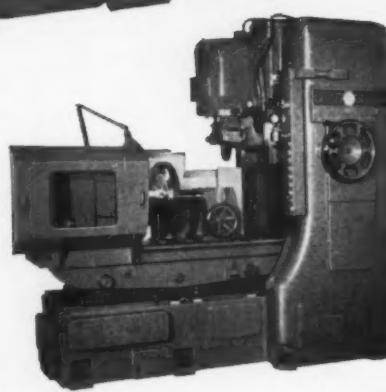


Table in
loading position

EXCLUSIVE RED RING ADVANTAGES

- Cutter above the work permits chips to fall away from and not into the cutter teeth.
- Thus positioned, the cutter is not vulnerable when the work is accidentally dropped while being loaded.
- Cutting pressure is applied downward, taking full advantage of gravity for rigid stability.
- Floor space, less — Rigidity, greater

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTID

NATIONAL BROACH & MACHINE CO.

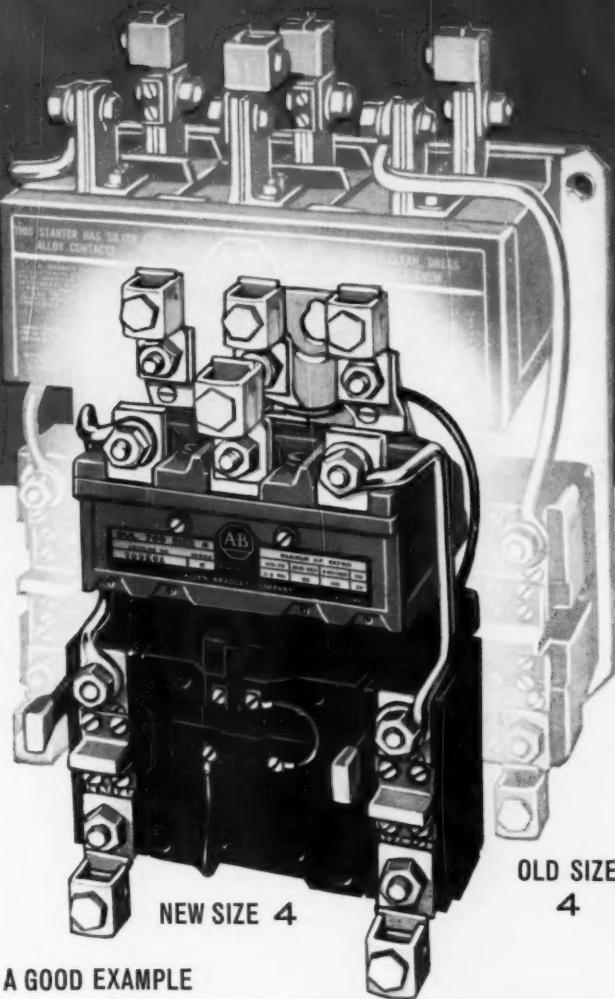
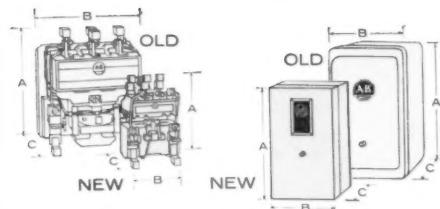
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PERFORMANCE**

**Plus
SMALLER SIZE**
with the new
Allen-Bradley
Bulletin 709 Starters



A GOOD EXAMPLE

The new revolutionary Bulletin 709 motor starters are surprisingly small in size—yet, they are good for many more millions of operations—without trouble or maintenance! Rating for rating, they have no equal. They are today's best starter value—and they cost no more!

The "Quality" you've come to expect in all Allen-Bradley control is represented in all details—especially in the "eye appealing" enclosures styled by the world famous industrial designer, Brooks Stevens. Write today for details of the new Bulletin 709 line—the greatest advance in motor control in 30 years: *Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.*

Check These New SPACE-SAVING Dimensions

14-61-RM

Starter Size	OPEN TYPE STARTERS						NEMA 1 ENCLOSURES					
	Height A		Width B		Depth C		Height A		Width B		Depth C	
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
00	4 $\frac{1}{8}$	—	3 $\frac{3}{8}$	—	3 $\frac{1}{16}$	—	7 $\frac{1}{16}$	—	4 $\frac{1}{8}$	—	4 $\frac{1}{2}$	—
0	5 $\frac{1}{8}$	5 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{3}{4}$	3 $\frac{1}{16}$	3 $\frac{1}{4}$	9 $\frac{3}{16}$	7 $\frac{7}{8}$	6 $\frac{3}{16}$	5 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{4}$
1	6 $\frac{5}{8}$	5 $\frac{1}{8}$	4 $\frac{1}{8}$	5	3 $\frac{1}{16}$	3 $\frac{1}{4}$	10	8 $\frac{1}{16}$	6 $\frac{1}{16}$	6 $\frac{3}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{4}$
2	7 $\frac{5}{8}$	10 $\frac{1}{16}$	4 $\frac{1}{8}$	5 $\frac{3}{4}$	3 $\frac{1}{16}$	4 $\frac{1}{32}$	12	14 $\frac{1}{2}$	7 $\frac{7}{8}$	9	4 $\frac{1}{8}$	5 $\frac{1}{16}$
3	10 $\frac{1}{4}$	12 $\frac{1}{8}$	6 $\frac{1}{4}$	7 $\frac{1}{4}$	5 $\frac{7}{32}$	5 $\frac{1}{16}$	16 $\frac{1}{8}$	19 $\frac{1}{2}$	10 $\frac{1}{8}$	11 $\frac{3}{8}$	7 $\frac{1}{4}$	6 $\frac{1}{16}$
4	11 $\frac{1}{8}$	16 $\frac{1}{4}$	7 $\frac{3}{8}$	12 $\frac{3}{4}$	6 $\frac{1}{8}$	6 $\frac{1}{16}$	22	26 $\frac{1}{16}$	11 $\frac{1}{8}$	14 $\frac{3}{16}$	8 $\frac{1}{4}$	7 $\frac{1}{16}$
5	15 $\frac{1}{8}$	20	9 $\frac{1}{2}$	16 $\frac{1}{8}$	8 $\frac{5}{8}$	8 $\frac{3}{4}$	32 $\frac{7}{8}$	41 $\frac{1}{2}$	17 $\frac{1}{16}$	19 $\frac{1}{16}$	10 $\frac{1}{8}$	13 $\frac{1}{16}$

ALLEN-BRADLEY

Member of NEMA

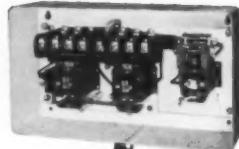
QUALITY
MOTOR
CONTROL

Your A-B Handy Catalog Lists These Control Devices Often Considered "Special"



BULLETIN 840
Float Switches

These quality switches are available in a wide range of types for automatic control of motors operating tank or sump pumps. The snap-action switch mechanism assures positive operation, no matter how slowly the liquid level changes.



BULLETIN 1270
Automatic Transfer
Switches

These switches are designed to transfer power load to standby supply when normal power fails or drops too low. Automatically returns load to normal supply when power is resumed. Mechanically interlocked.



BULLETIN 805
Foot Switches

Ruggedly built to withstand the most severe industrial usage. Snap-action switch mechanism features maintenance free silver contacts. The foot switch shown above assures complete "safety" for the operator. Also made without top guard.



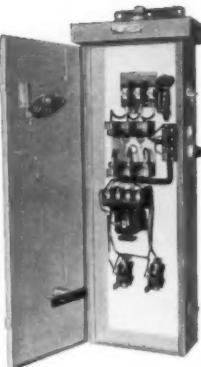
BULLETIN 836
Pressure Controls

For machine tool hydraulic systems operating at pressures up to 5000 psi. Oiltight enclosure. Operating pressure and differential are adjustable. A visible indicator shows trip point. Maintenance free silver contacts.



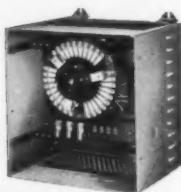
BULLETIN 812
Phase Failure—Phase
Reversal Relays

Style F relay (above) protects against all open phase conditions on a branch motor circuit. Style R disconnects the motor upon a phase reversal. Style RF gives phase failure and phase reversal protection.



BULLETIN 1232
Pump Control Panels

Complete units for automatic operation of irrigation and oil well pumps. Employ standard A-B Bulletin 709 magnetic starter with manual disconnect switch or circuit breaker in weatherproof enclosure. Wide variety of optional features available.



BULLETIN 555
Speed Regulators

Provide manual speed control of wound rotor motors for either fan or machine duty. When used with magnetic starter, the first step closes control circuit.



BULLETIN 803
Rotating Cam
Limit Switches

Heavy-duty controls for use on automatic production machines. Made with up to 12 independent circuits which can be separately adjusted for operation at any point of rotation.



BULLETIN 365
Multi-Speed
Drum Switches

Designed for manual starting, speed changing, and reversing of polyphase multi-speed motors. Made for up to four speeds either non-reversing or reversing.

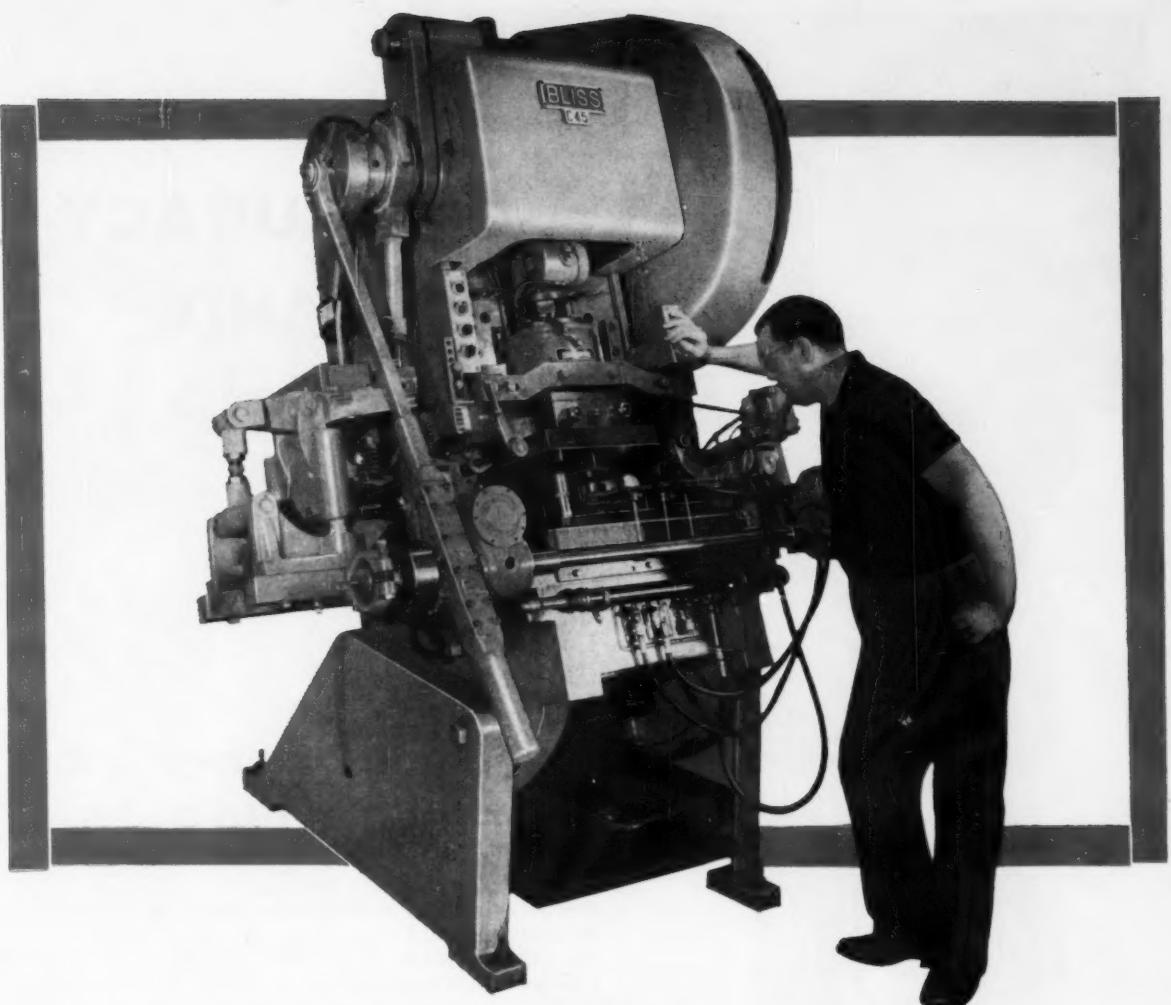
ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

QUALITY
MOTOR
CONTROL

14-61-RM



PRODUCTIVITY... that raises output 100% or more with new Bliss Big "C" inclinables

Raw strength and precision manufacture combine to make Bliss' new Big "C" Series presses the most productive inclinables ever built. How? Because the massive strength of the frame keeps deflection to the barest minimum. And because all of the moving parts are hand-fitted to tool makers' tolerances, making higher speeds practical.

Here's a case in point: Victor Adding Machine Co., Chicago, Ill., uses three new Bliss C-45's for heavy-duty blanking work on parts for the famous Victor Automatic Printing Calculator. Equipped with Bliss CK air-friction clutches, the C-45's have automatic feeds and variable speed drives. Result: yield of stampings has gone up as much as 114%, depending on the part, over that of previous presses. It's no wonder that Victor Adding Machine now has fourteen Bliss Big "C" inclinables in service. There is many another "plus" in these new presses...advantages like extra die space...large openings in bed and frame...precision-forged crankshafts...compact combination controls...semi- or fully-automatic lubrication...bronze ball seats...lamina bronze gibs...mechanical or air clutches...geared or non/geared models...powered unsticking device. There's a lot more information about Bliss Big "C" inclinables in our new color catalog. Why not write for your copy today?

BLISS is more than a name...it's a guarantee

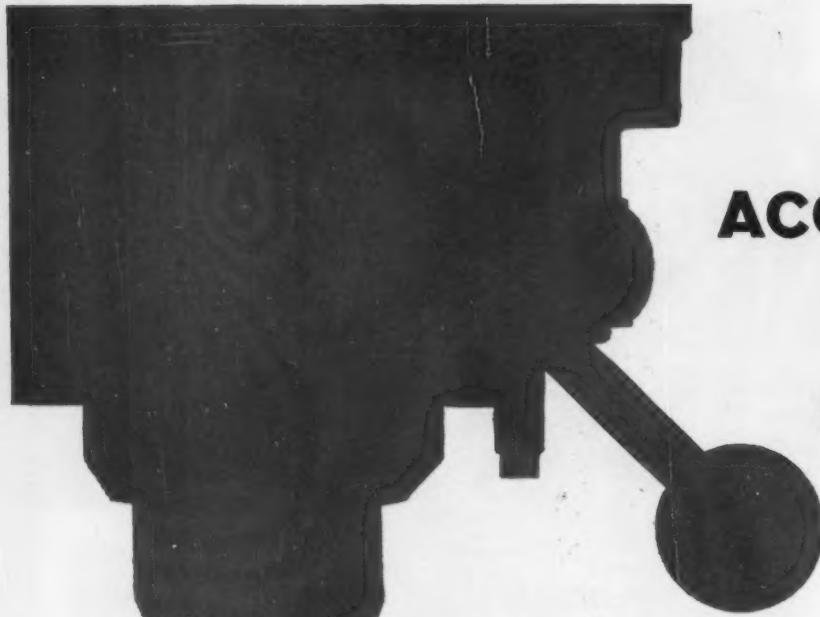
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BLISS
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ACCURACY AND GRIP...

• Precisely the point...



When you buy new tools or rebuild old ones

START UP FRONT

- Precisely the point where the tool does its work.
- Precisely the point where profits are made and lost.
- Precisely the point where the accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

This is precisely the point, start up front with Jacobs.

The Albrecht Chuck is the world's finest heavy duty keyless drill chuck. It is ideal for use on high speed, sensitive drilling machines, for close tolerance work on milling machines or jig borers.

- All working parts ground and hardened
- Every piece interchangeable
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INDUSTRIAL TEAMWORK

Your industrial supply distributor knows your business. He is always ready to fill your needs quickly and economically. When you need chucks you can depend on this industrial team—Jacobs and your Jacobs industrial supply distributor.

Jacobs CHUCKS



THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT



Bethlehem circular forgings are available in carbon, alloy, and stainless steels, and some heat-resistant grades. 10 to 48-in. OD, 100 to 2,000 lb. As-rolled or rough-machined to specifications.

Which cost less, castings or circular forgings?

In initial cost, a Bethlehem circular-forged blank is competitive with a cast blank.

But that's where the competition ends.

Due to the hot working of the metal (our unique Slick Mill forges and rolls a circular product in one operation in one minute), forgings have better physical properties, greater strength than castings.

HIGHER CUTTING SPEEDS—The uniform quality of Bethlehem circular forgings allows you to use higher cutting speeds. Machining time—both in roughing, and in hobbing

teeth—is cut; tool life is increased. And there's no chance of sand damaging valuable hobbing tools.

LESS METAL—You'll find, in many cases, weight can be reduced. The greater strength of a forged circular product permits thinner rim sections without sacrificing strength.

Our sales engineers will be happy to give you the whole story on Bethlehem circular forgings—competitive initial cost, sure machining savings, possible weight savings, a better-quality product all around.

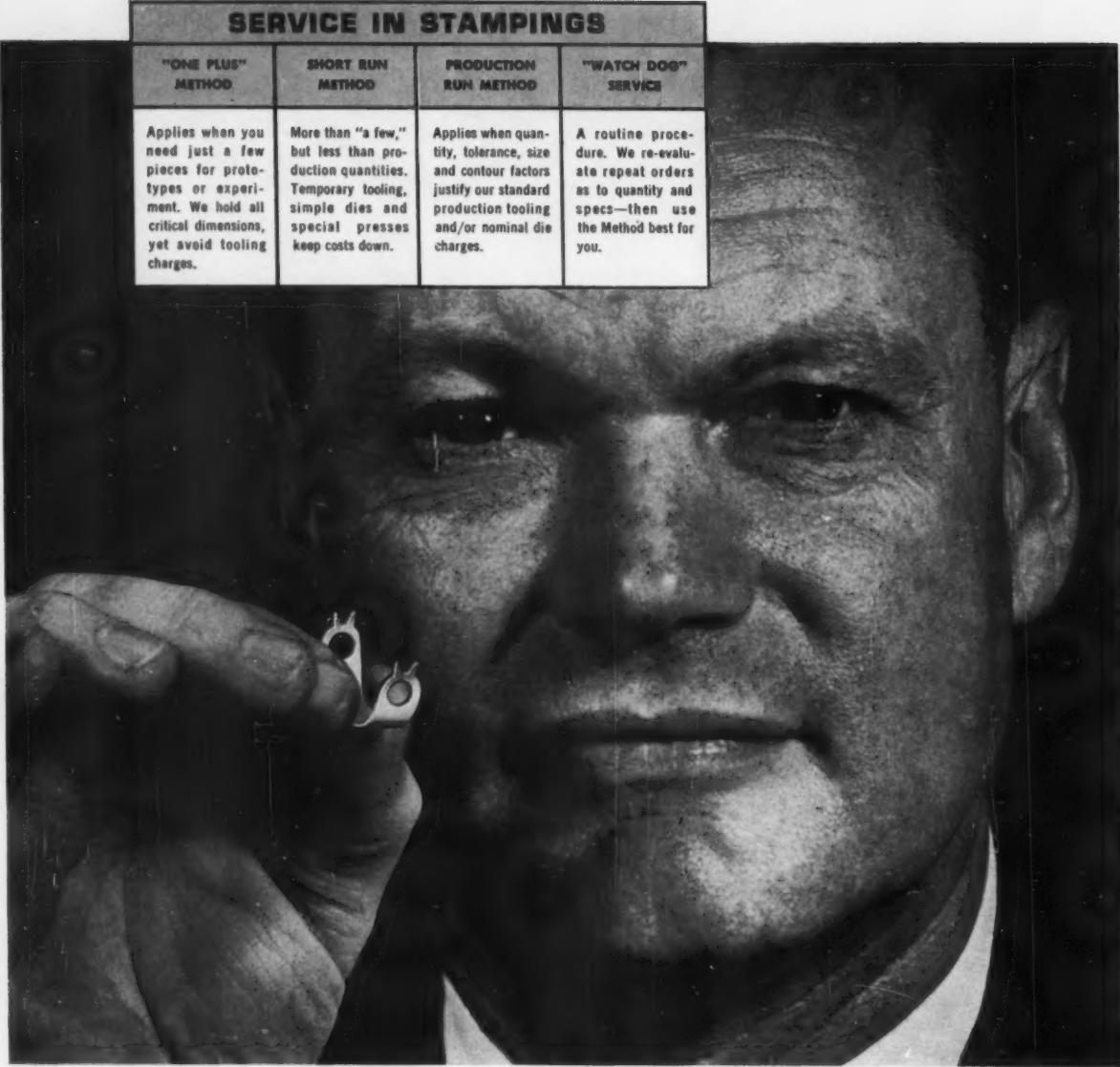
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation



for Strength
... Economy
... Versatility

BETHLEHEM STEEL





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We have been producing Stamped Metal Parts at the Laminated Shim Company, not as a sideline, but as the mainstay of our business since 1913. That's important for you to know. It is just this kind of experience and specialization that provides you with an unmatched Service in Stampings as near as your phone.

With this Service you get top quality Stampings . . . (1) in any size, any shape, ranging from tiny lock washers to electronic chassis to husky

rocker arms . . . (2) in any quantity, from a single prototype to a million or more . . . (3) all within accepted tolerances and finishes for the class of work involved . . . (4) at surprisingly low cost.

So . . . for better Stamped Metal Parts, faster and at low cost, call DAVIS 5-2631 or send your prints for quotes directly to the . . .
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3909 Union Street, Glenbrook, Conn.

Loring F. Overman

- ★ GAO Cites "Costly Duplication"
- ★ SBA and BDSA Encourage Exports
- ★ Depreciation Allowances; Tax Credits
- ★ Washington Briefs

WASHINGTON HEADQUARTERS for the machine tool industry—the National Machine Tool Builders' Association—has devised a completely new approach to one of the major problems involving the New Frontier, the new inflation, and the spiraling costs of intricate new machine tools. Nearing completion are plans for a series of top management seminars to be held in cities from coast to coast, to "sell" both Government and industry on the economics of employing up-to-date machine tools.

Reasoning behind the seminars, according to NMTBA spokesmen, is the fact that tape-controlled machine tools involve expenditures of such large amounts of money that when such machine tools are under consideration, purchase decisions are increasingly made by company presidents, treasurers, comptrollers, and others who think in terms of economics rather than those whose prime responsibility is production.

"The seminars will introduce to both government and industrial executives an entirely new concept of the advantages, and the necessity, of modernizing our country's productive facilities," commented Ludlow King, NMTBA's executive vice-president. "The seminars, to be conducted in conjunction with the American Machine Tool Distributors' Association, will point out the over-all contributions modern tooling can make to the national economy. A modern tape-controlled machine tool, for example, will not only produce most effectively, but will replace enough jigs and fixtures to fill a warehouse."

"Machine change-overs can be made by the simple alteration of a tape, eliminating costly and time-consuming changing of tools and fixtures. With the Administration committed to a speedy upgrading of national defense production facilities, the coming seminars should provide welcome and convincing evidence that modern machine tools will more than pay their own way."

GAO Cites "Costly Duplication"

Possibly typical of the need to sell comptroller-minded executives on the economics of modern tooling is the recent General Accounting Office report, "Review of Management of Idle Production Equipment Within the Defense Department." The report, presented to Congress, contends that separate production equipment programs conducted by each of the military services saddle the Government with unnecessary costs. In addition, the report indicates that duplication is "adversely affecting utilization of idle assets in lieu of new acquisitions."

The report estimates that the military services have some 140,000 idle machine tools and other production

equipment in inventory. Out of a total of some 500,000 items, the report states, failure to utilize idle assets has resulted in unnecessary procurement amounting to more than \$700,000. Fiscal 1961 procurement of machine tools was estimated at \$63,000,000. Study of the problem is to continue, with special consideration to be given to a single management plan. Completion of the study by April, 1962, is planned.

Meanwhile, government-industry committees seek solutions to the physical problem of government surplus tools, and NMTBA seminars will follow through with top-level sales arguments which will favor a thorough modernization.

SBA and BDSA Encourage Exports

Steps to make export business easier for machine tool builders and others are being taken by the Small Business Administration and the Business and Defense Services Administration, as well as by congressional tax writers. BDSA has a series of world trade fairs in preparation, with participation open to machine tool companies. Information concerning the trade fairs may be obtained from the Metalworking Equipment Division, BDSA, Department of Commerce, Washington 25, D. C.

The Small Business Administration is offering several types of encouragement to small firms interested in overseas activities. Congressional concern includes consideration of tax concessions for firms opening overseas production facilities. Both the National Machine Tool Builders' Association and the Machinery and Allied Products Institute favor continuation of realistic tax plans to encourage United States firms to compete with foreign countries on their own home grounds.

Depreciation Allowances; Tax Credits

Machine tool people in Washington consider as "inadequate but a step in the right direction" the House Ways and Means Committee proposal for an 8 per cent across-the-board tax credit for investment in tangible personal property having a useful life of six years or more. The committee proposal included an over-all limitation of 50 per cent in the reduction of tax liability in any one year, except that the limit would not apply to the first \$100,000 of tax liability. If Congress accepts this recommendation, the maximum credit that could be taken against a tax liability of \$150,000 would be \$125,000. Also, investment in used equipment would be eligible for the 8 per cent credit to the extent of \$50,000 of such investment expenditure in any taxable year.

Washington Briefs

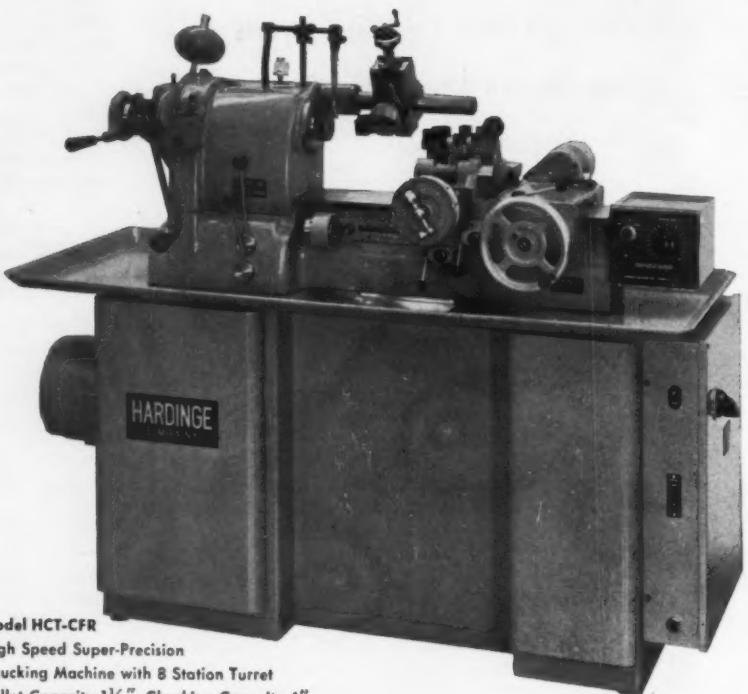
From the Buck Rogers department in Washington comes news that a back pack for space mechanics is being considered by the Air Force Systems Command. The pack is intended to provide control over weightlessness while making external repairs on space vehicles in flight. The Air Force has pointed out that some sort of harness is required to enable the space mechanic to cling to the surface of the space vehicle while attempting repairs. Several "stabilization" systems are now under consideration.



THE EASE AND SIMPLICITY OF OPERATION OF
HARDINGE SUPER-PRECISION PRODUCTION MACHINES
ENABLES RELATIVELY UNSKILLED OPERATORS TO PRODUCE
PARTS TO CLOSE LIMITS WITHOUT EXPENSIVE TOOLING.

MODEL HCT-CFR

The Model HCT Chucking Machine can finish diameters, shoulders, and end faces, and cut precision threads in one setting—all concentric with each other. Adjustable, exact cutting positions produce closer tolerance parts on a production basis. It assures tool room accuracy and low part cost.



Model HCT-CFR
High Speed Super-Precision
Chucking Machine with 8 Station Turret
Collet Capacity 1 $\frac{1}{8}$ ", Chucking Capacity 6"



Model DSM59
High Speed Super-Precision
Second Operation Machine—Collet Capacity 1 $\frac{1}{8}$ "

MODEL DSM59

This time-tested production machine is easy to set up and enables relatively inexperienced operators to turn out parts rapidly within close tolerances and to fine finish. Operations on this machine reduce expensive tooling, upkeep, and down time of automatics.

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PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE



20,000 Times a Second!

OUR SPACE AGE has brought out a new vocabulary that is fully understood by most scientists but often mystifying to those of us whose everyday world is on a more prosaic level. Some of these terms, however, relate to scientific facts that have come into fairly wide practical usage during the last few years.

Take the term "ultrasonic." This is a word that indicates vibrations in excess of 20,000 per second—a constant stream of vibrations being delivered faster than the speed of sound. With the application of ultrasonic vibration for a variety of practical purposes, the term has become universally known throughout industry.

It is appropriate to here mention some of the current applications of high-frequency vibration. One of the most important is for the agitation of fluids, primarily for cleaning metal parts either to insure reliable operation or to obtain a good appearance. Fluid vibration is also used to accelerate pickling operations.

Ultrasonic equipment is being employed increasingly for detecting flaws in welded joints, forgings, castings, and other metal products. Closely allied to this application is the use of ultrasonic vibration for measuring the thickness of metal parts in cases where only one side of the part is accessible. The extent of corrosion of a part in service can also be determined by this technique.

Ultrasonic vibration in combination with electric current provides the means for "spark machining," now quite widely used for operations on hard and brittle materials. Ultrasonic welding is another process that opens up opportunities for the joining of metals. Still another application of ultrasonics has been in the field of grinding, where high-frequency vibration imparted to the grinding coolant reduces and even eliminates the build-up of metal particles on the grinding wheels.

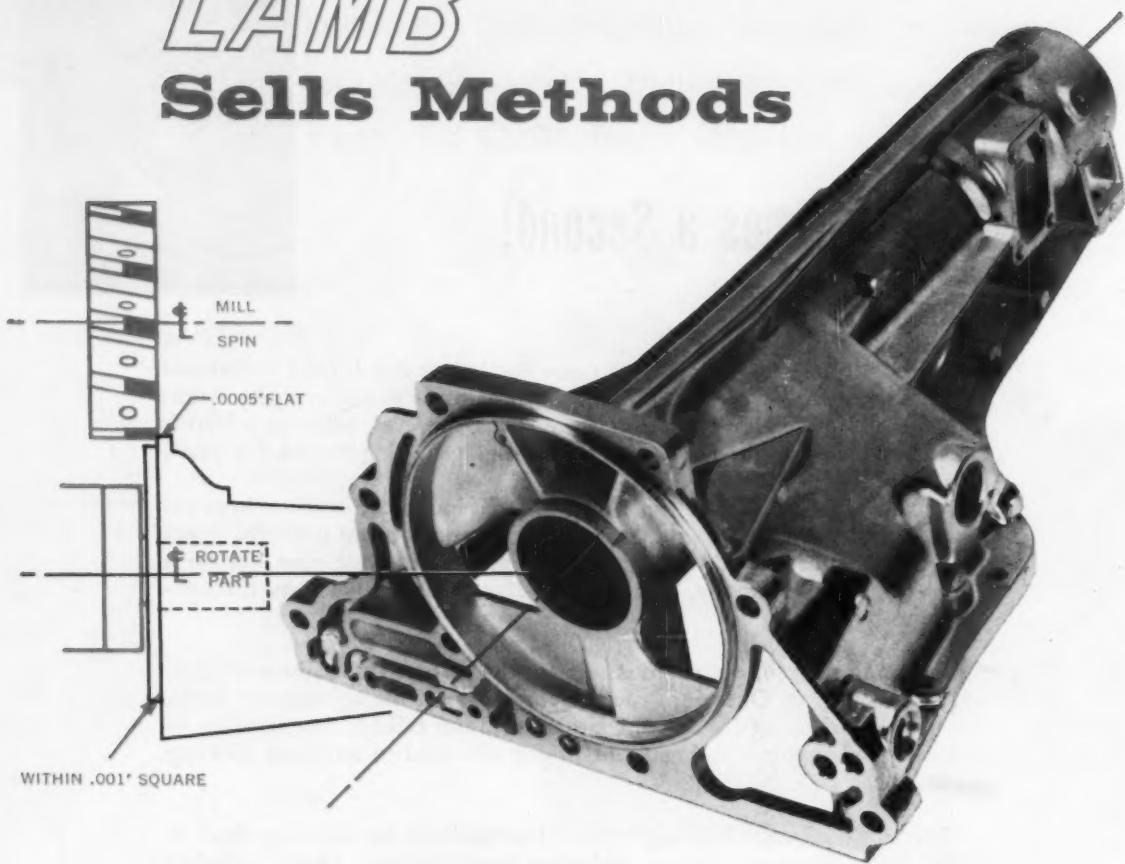
The utilization of ultrasonic vibration for practical purposes is still comparatively new. There is no reason to suppose that its potentialities have been fully realized.

Charles O. Herb

EDITOR

LAMB

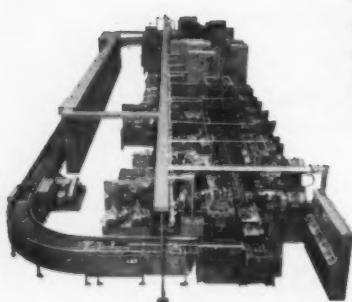
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200 transmission rear bearing retainers/hr

45 station palletized transfer machine

With Lamb's "methods" approach you buy top production at minimum cost per piece—nothing more or less—because all essential factors are considered including: metallurgy, shape, tolerances, assembly, pre- and post-process. It's on machines like this one that Lamb's reputation was built.



F. JOS

CO.

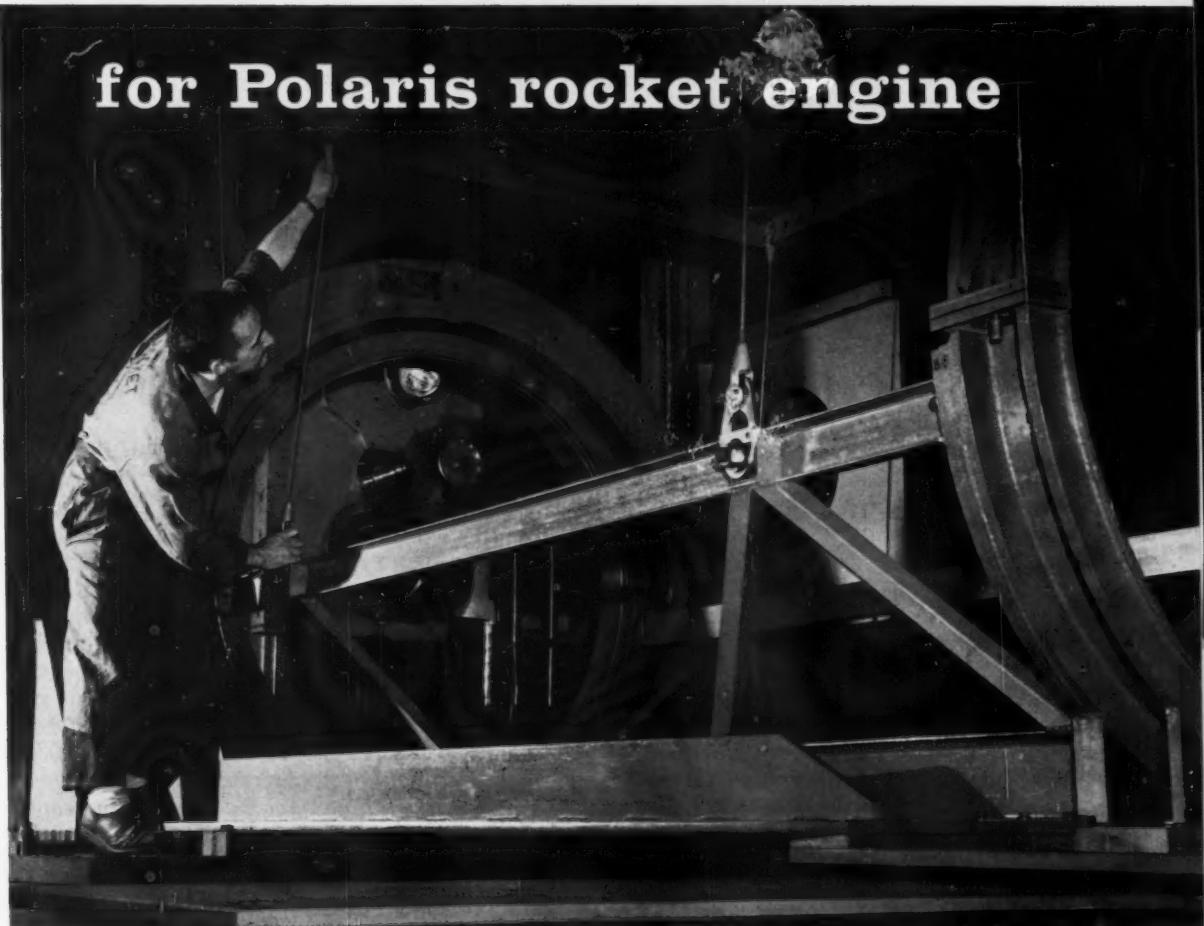
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Since 1914 Engineers and Builders of Special Machines and Automation Equipment

Solid-fuel cases tapped hard

for Polaris rocket engine



What has made the Polaris the most successful and most feared United States deterrent is that it was designed, engineered, and is built that way. Even a simple fuel-tank closure for this missile shows the result of practical planning plus sound research

LAURENCE W. COLLINS, Jr.
Associate Editor

FIRED from a submarine, the Polaris missile represents the United States' brightest operational defense accomplishment after several years of discouragement and disappointment that started with Sputnik. Polaris is America's rocket effort in a mature stage. The Navy vehicle con-



sists of fuel stages and nozzles; control and directing instruments; and, if necessary, a warhead. Also, it is arranged to be fired from a submerged submarine.

Simplified, its structure is a cylindrical case pointed at one end. Nothing in the construction or design of the case or fuel cell has been left to chance. There is a typical example of the high degree of engineering care in the fuel vessel. This tank is basically a lightweight cylinder of the greatest strength and precision, made to the most exacting standards of modern production.

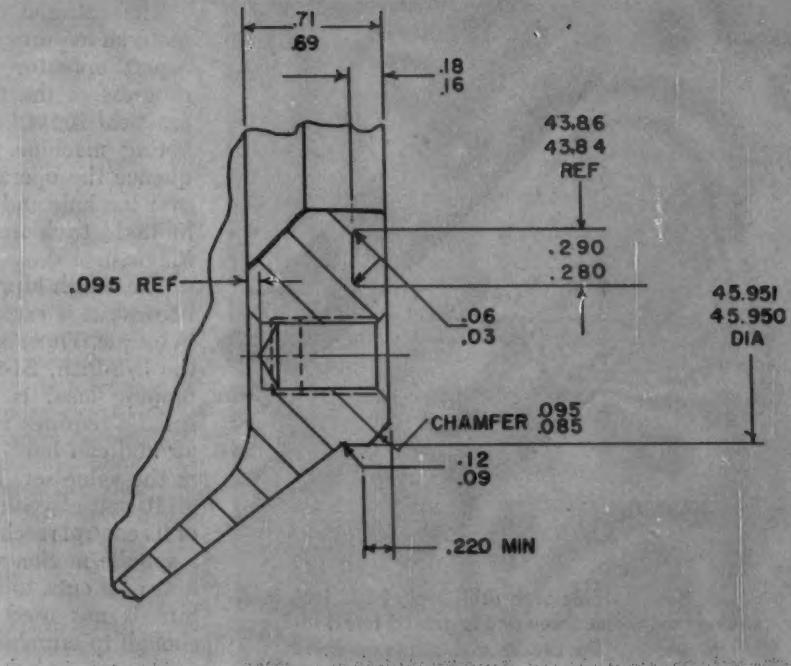
Recently the Rocket Engine and Testing Operation of General Electric Co.'s Evendale, Ohio, plant received a four-unit development order for cases. The vessel is 54 inches in diameter and 13 feet long, Fig. 1. It is made of a modified A1S1 4340 alloy steel, called 300M. This high-performance alloy has a tensile strength in excess of 270,000 psi. To avoid the possibility of failure inherent in longitudinal welds (normally used in making such a vessel out of rolled-up sheet) the main cylinder is shear-spun. The walls have a thickness of only 0.120 to 0.124 inch. One end is capped with a dished head which is tungsten inert-arc welded to the interior wall, on the faying lap fillet. The opposite end of the tank has a dished and flanged skirt also welded to the tank wall by the same joint design. The 45-inch diameter flange receives a dished closure, or cap, with four nozzle ports.

Machining of the cylinders is unusually precise for so large a work-piece. Fastening holes in the case flanges at either end must be highly precise on all centers, which means 0.005-inch maximum tolerance. Also, the flange holes at one end must bear an exact angular relationship with those at the opposite end, in order to mate with the bolt holes in the rocket's outside casing at assembly.

The closure end cap is fastened to the case flange with 150 bolts, all equally spaced and precisely positioned with relation to the edge of the flange, Fig. 1. These are blind holes, only 0.600 inch deep, and each one must be threaded with a 3/8-inch, 24-thread-per-inch tap *all the way to the bottom*, Fig. 2. Here is a most difficult tapping problem for several reasons. First is the fact that following welding, and prior to machining, the whole vessel is heat-treated and tempered to Rockwell C 54 to 56, which results in a Martensitic microstructure. Also, there can be only one cutting pass with the tap because the already-hard metal burnishes and strain-hardens with the first tool pass. The normal hazards of tapping are present, such as breakage through bottoming, short tool life, difficult tool geometry, and the need for a UNF-2B, 0.435-inch minimum, "perfect" thread depth. Tapping after heat-treatment is required in order to avoid the loss of hole-true position that might occur if the flange were tapped in annealed condition and hardened later on in the manufacturing sequence.

Fig. 1. (Left) The manufacturing engineer checks one of the 150 bolt holes in the heat-treated closure flange of the case.

Fig. 2 (Right) Cross section of closure flange bolt thread and dowel-pin hole. Note the tolerance of the bottom web of blind bolt hole.



Obviously, the devising of methods and the selection of equipment, fixturing, and small tools was a project requiring a great deal of experiment, in which uphill work and painstaking study finally resulted in a successful procedure. The heat-treated flanges are faced, turned, and bored, and the end mounting holes drilled on a Giddings & Lewis boring mill. Using the same machine, the flange holes are also drilled in a special turnabout fixture (heading illustration). The use of this fixture permits the end flange holes to be drilled without removing the case from the setup, thus maintaining the angular relationship of the hole center lines from end to end at the specified tolerance.

For drilling the blind flange holes, solid carbide Type 883 stub-length drills 0.328 inch in diameter are used (Fig. 3, top). The design of these tools calls for a heavy web. During sharpening, the web is thinned in order to improve the cutting quality of the point, which is ground to a special 118-degree radius. During cutting, the drill is turned at 40 sfpm with 0.003-inch feed per revolution. Satisfactory results depend upon holding a high degree of rigidity. Therefore, a solid backup fixture is used. For a drilling coolant it was found that an active chlorinated-sulphonated cutting oil, such as Threadcut 99, is satisfactory. During the drilling operation, the operator carefully watches the drill point for wear and signs of dulling at the spade or lip corners. He is

required to change to a sharp drill before a 0.010-inch wear land develops. The practice of using only sharp drills prevents the sides of the hole from becoming burnished and strain-hardened, which would make the following reaming and tapping operations impossible.

After drilling, the hole is reamed to bottom the blind hole to a 0.600-inch depth, and to obtain a diameter of 0.3389 to 0.3405 inch with squared bottom corners, Figs. 2 and 4. With this hole size, a thread can be cut to approximately 70 per cent depth to meet the specification. The web at the bottom of the hole must have a minimum thickness of 0.095 inch. For tapping the closure flange holes, the case is placed vertically on the floor, Fig. 5. This requires the use of staging so that the operator can run the tapping head. A horizontal position cannot be used because the tap must be submerged in the volatile cutting lubricant during threading. The tapping head is a shop-built arrangement using an adapted Buffalo bench-model drill-press base, column, and bracket supporting a Smith Model E head. The base of the drill press is bolted to a fixture plate which has a bottom rabbet that closely fits the inside (43.660-inch) diameter of the closure's bolt flange, Fig. 6. The arm of the drill press is reversed on the column from the usual position so that the center line of the taper spindle is directly over the hole to be tapped (heading illustration).



Fig. 3. Solid carbide stub drill (top), 0.328 inch in diameter, has thinned web and is ground to a 118-degree arc to improve lip corner and spade wear. (Bottom) Nitrided six-flute stub tap, Rockwell C 68, is oxide-coated to improve cutting in martensitic steel flange.

The extreme difficulty of tapping hardened material requires close attention on the part of an expert operator who is trained to "feel" the progress of the tap. Thus the operation is not practical for a heavier machine tool such as a boring machine. When starting a tapping sequence the operator positions the head radially over the hole and fills the hole cavity with an inhibited trichlorethane coolant, called Tap-Magic.

The Smith tapping head, Fig. 7, was selected because it is extremely sensitive to any increase in torque. Thus, tap breakage is prevented. Using the 3/8-inch, 24-thread tap, the setting of the tapping head is 430 inch-pounds. The tapper spindle requires about 90 pounds of compressed air and can hold a torque value within 1 ounce of the value set. The tapping head also requires a 110-volt electrical connection for the operation of its control mechanism. This device incorporates a spindle motion which oscillates the tool in the hole as it cuts, to break chips. However, this feature is not used because the chips are hard enough to crumble.

The tap is held in a Model C 10040 Jacobs tapping chuck in a vertical floating mount. Hole

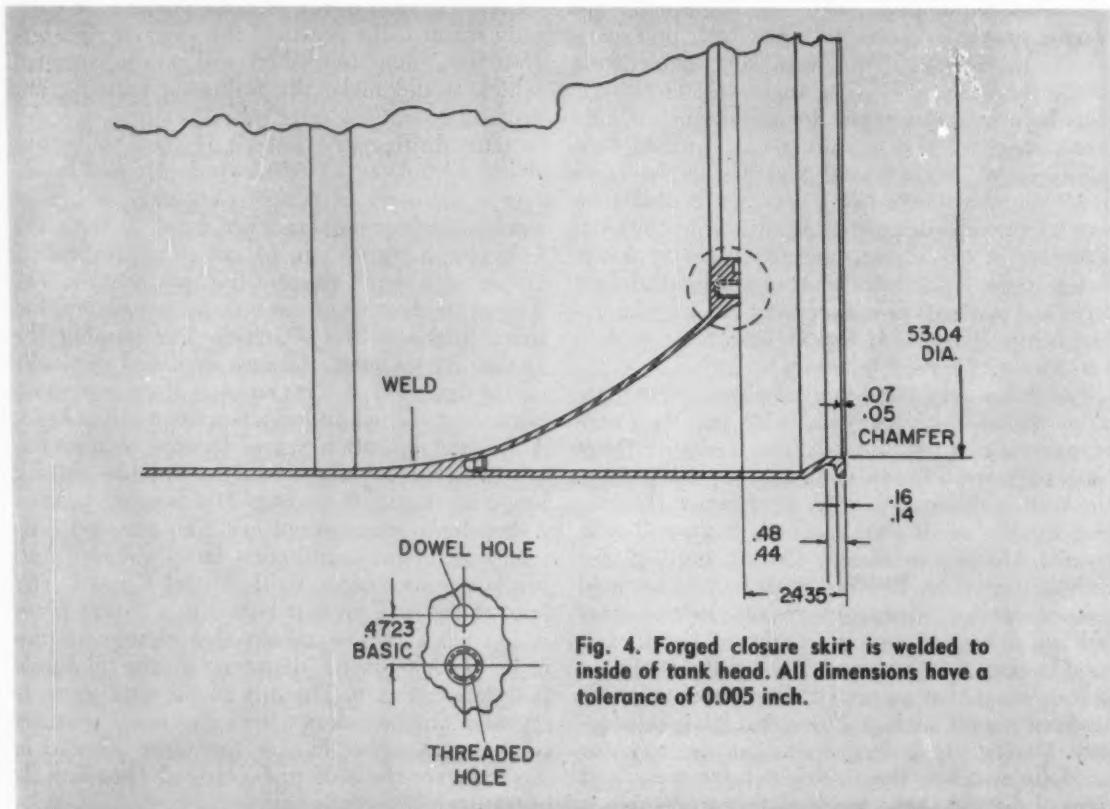


Fig. 4. Forged closure skirt is welded to inside of tank head. All dimensions have a tolerance of 0.005 inch.

METHODS ASSURANCE

The manufacture of space-age components emphasizes the necessity of devising processes that will assure making the component right the first time. Small and minor operations, if faulty, can easily scrap an item costing \$50,000 to \$100,000. Rework can frequently cost many times more than the original operation. In rocket construction, design engineers work with materials at their upper limit of strength. It follows, therefore, that the manufacturing engineer on rockets must work at the upper limit of his processes to assure reliability. Being right the first time requires great attention to detail. No manufacturing engineer can be sure of his process without close attention to the smallest elements of every parameter.

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alignment is attained by using a plug ground slightly under the reamed hole size and inserted through the baseplate into a bolt hole near the one being tapped. The tapper spindle turns at 40 rpm, giving a cutting speed of approximately 4 sfpm.

For threading work in martensitic steel, the design and manufacture of taps is extremely critical. The development of these taps required many trials over a period of months with the co-operation of a number of different suppliers. All of their final designs have been successful, once basic geometry, material, heat-treatment, and surface coating were established. The taps have a stub design (Fig. 3, bottom) to eliminate the effects of "wind and unwind." They are made of M3 high-speed steel, nitrided to a hardness of Rockwell C 68. The M3 steel alloy contains (nominally) 1 per cent carbon, 6 per cent molybdenum, 4 per cent chromium, 2.4 per cent vanadium, and 6 per cent tungsten.

This material, because of its high vanadium content, develops an unusually fine grain size, giving the edge excellent toughness, strength, and abrasion resistance. It can attain slightly greater hardness than standard grades of high-speed

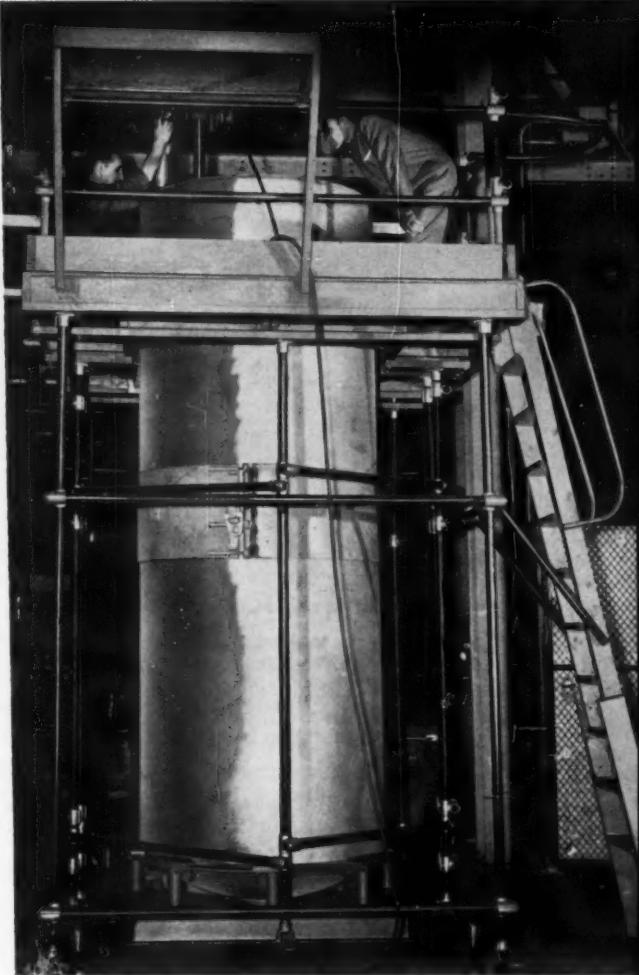
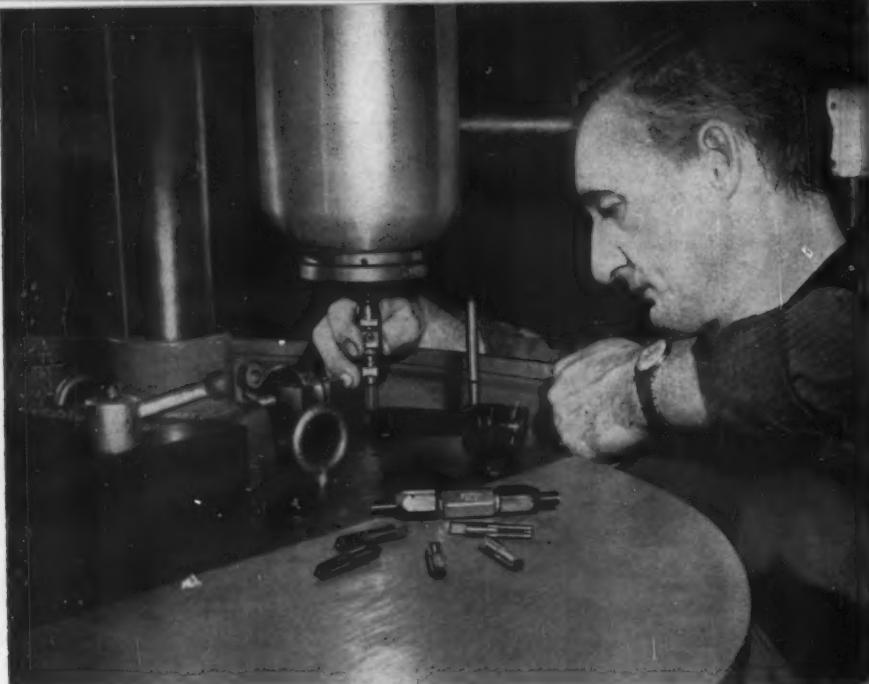


Fig. 5. To hold the volatile lubricant in the hole, the tapping must be done vertically, with the operator working on a staging for access to the top of the 13-foot case. The tap must run flooded at all times.

steel. To improve wear resistance, the taps are nitrided after a triple temper, and before thread grinding, during their manufacture. As a final measure, the tap is given a coating of ferrous oxide to decrease chip welding and also to relieve possible residual grinding strains. The M3 material has further shown that there are no concentrations of large undissolved carbides in the structure after hardening.

Taps have six flutes and "hook" is ground neutral to increase tooth strength. No rake is needed to curl the chips because they crumble. The taps have a surface hardness of Rockwell C 66 to 68. Because the tap must thread the hole all the way to the bottom in one pass, only a small chamfer can be ground on the point. This relief can extend backward no more than three thread crests.



Contributing also to the success of this tapping operation has been the selection of cutting fluid without which a tap would be ruined by cutting the threads in only one hole. The inhibited trichlorethane is a water-thin, volatile fluid, classed as an extreme-pressure lubricant. It is designed for slow-speed cutting. The theory of its excellent lubricity is that the vapor from the fluid penetrates spaces between the chip and the tool, reacting with the chip material. Chemical action forms an iron chloride at the high pressure and temperature created. Iron chloride acts to reduce friction and torque. The result is an exceptionally high finish on the thread faces. But the primary objective is to extend tool life.

It should be noted that other materials, such as trichlorethylene and carbon tetrachloride, could be used to lubricate these taps. However, these have the drawback of being much more toxic than the trichlorethane, which is classed as only "slightly toxic."

Companies which cooperated in supplying successful taps for this operation are Jarvis Corporation, Sossner Tap & Tool Corporation, Winter Bros. Co., Hy-Pro Tool Co., and Threadwell Tap & Die Co.

Fig. 6. (Above) Drill-press base is clamped to fixture plate resting in the case flange. Smith tapping head provides precise torque control.

Fig. 7. (Right) Smith tapping head permits operator to "feel" the progress of the tap in the hole for best tool life and quality of finish.



SAVE through modern hammer maintenance

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SAVE

Operators of hammers still make the same hammer-maintenance errors that their fathers made forty years ago, and with the same expensive consequences. Through sloppy maintenance control, anvils and sow blocks still crack, piston rods snap, and rams break. Most of these breakdowns can be traced to the same unnecessary maintenance errors that have caused costly hammer failures for generations. Good controls alone can trim this burden

FORGING HAMMERS are shock-producing, or impact, machines. They exist for pounding purposes, but take a rugged beating themselves in the process. Preventive maintenance is far less costly than expensive repairs and losses for down time. A new concept in controlled maintenance will produce savings. Use of control will pay off.

A simple check list for use at the start or end of shift can be a primary step in the direction of better maintenance. A more comprehensive list should be checked once or twice each week. Often it is better to shut down a hammer to make minor repairs disclosed by such a checkoff than to wait until neglect produces a major failure with possible costly and serious consequences.

Precise Adjustments Necessary

The shutdown of any machine, even for minor repairs, is expensive. One reason forging presses are chosen in preference to hammers is the relatively high cost of keeping a hammer operating.

Precise adjustments are necessary in a hammer to compensate for wear and to allow for the expansion of metal as heat is absorbed by the hammer ram, sow block, and anvil. Many times these adjustments are made—as they should be—by machinists from a maintenance department or the plant engineer's department. At other times the adjustments are made by the operators themselves, who usually take the easy way out. Unfortunately, this method may be faster but often results in misalignment of the hammer. Training is necessary if the operator is to be entrusted with this responsibility. Often retraining is indicated to break old habits and begin a control program.

The general alignment of the hammer has a direct relationship to the life of all components. The ram should always be centered and the guides and frames should be aligned at all times to guide the ram. The frames must seat squarely on the anvil. If they are heeled-in to align the dies or to compensate for wear in the ram guides, the anvil-to-frame bearing area is reduced. This



Fig. 1. Board drop-hammers are producers, but they are expensive if not carefully maintained.



Fig. 2. Steam drop-hammers have a tendency to pound themselves to pieces under continued use.

will result in excessive and rapid wear on both parts and eventually lead to inaccurate forgings.

Ram Slapping Causes Rod Breakage

Adjustments should be made as often as necessary in the ram guides. This keeps the ram from becoming loose, thus causing a slap from one side to the other. Such slapping usually results in rod breakage, most commonly at the top of the taper of the rod.

An exception to this rule for adjusting guides is when the hammer has these portions integral. In this case the frames should be drawn in as much at the bottom as at the top to take up wear. This must be done, always keeping the frames seated squarely on the anvil, and with the tie-plate seated squarely on the frames.

There is usually some distortion in guide alignment when the frames and anvil are warming up. Bearing is then concentrated on that part of the frame seat near the sow block. When the several parts reach uniform temperature, the frames

should again seat evenly on the anvil face.

The hammer frame is backed by an adjusting wedge which serves to shift its upper works across the anvil to line up the die impressions. Each time this shift is made, the frames must be checked to see if they are still parallel. A tram, or inside calipers, or a micrometer should be used to be sure that measurement from one frame to the other at the top is the same as that at the bottom of the machined guide-pocket face on each frame, to assure alignment.

Hammer guides wear fastest at the bottom. All too often the frames are moved inward at the bottom to compensate for this wear (which has not occurred in the middle or top sections of the guides). When this has been done, the frames do not seat properly and squarely on the anvil. Operators should make needed adjustments only with the guide-adjusting gibs to provide the proper fit of the ram in the guides. Unfortunately, moving the frame is easier and quicker and, apparently, more popular than the proper method of using the adjusting gibs.

Bottom of Guide Wears Faster

Veteran hammer men are familiar with the fact that the guides in new hammers are farther apart at the top than they are at the bottom. This seeming discrepancy is planned to give the ram relief as it moves upward. The objective is to maintain a tight fit at the bottom for the best alignment when die meets die. But this is the reason for accelerated wear at the bottom of the guides.

Even when the frames are kept seated squarely on the anvil, and the guides are adjusted properly with the wedges, there eventually comes a time when further adjustments (even though correctly made) result in the ram sticking in the middle of a stroke, on the hump. The only way to avoid ram jam is to replace guides before they wear to the hump stage.

The fit of the guides should be accurately checked and adjusted frequently at the beginning of each shift as the ram and guides heat and expand. Thus sufficient bearing is maintained for accurate die alignment. Excessive tightness of the guides must be avoided to prevent scoring of bearing surfaces.

Rams, sow blocks, and anvils, of course, are subject to breakage, particularly if the hammer is mishandled, misaligned, or used without warm-up in cold weather.

If the guides, the die notch, and the bottom face of the ram are maintained in good condition, a ram will last a number of years without removal. But abuse of the ram can result in a removal for redressing the die-notch dovetail in as short a time as thirty days.

Hammer Pounds Itself to Pieces

When finishing a drop forging, the last blow of the hammer exerts a tremendous force against the bottom die and the sow block. This is transmitted to the anvil, setting up high stresses in the area of the sow-block seat. The applied force tries to drive the sow block downward through the middle of the anvil, while its ends remain static by their own inertia. With the ends and the center of the anvil tending to pull away from one another, a shear stress is induced in the anvil and in the fillet area on each side of the sow-block opening. However, the force of the hammer blow itself, and the resulting stresses, are not normally sufficient to cause anvil breakage. Such breakage is usually caused by a compounding of forces, with ill-fitting keys, wedges, and dowels predominating.

A poorly tapered dowel, forced by extreme pressure into a small area it does not really fit, can set up stresses before the hammer blows begin. The additional stress from the hammer blows

becomes too much for the material to bear. The result is dowel breakout.

A tremendous number of anvil breaks are caused by ill-fitting keys. A prime example is that of a key area 10 inches high and 40 inches long, having a poorly fitting key bearing on only 10 inches of its total length. Hammer blows induce excessive pressure on the small bearing surface. Thus a fracture or crack begins in the fillet of the anvil adjacent to the key-bearing surface. To prevent such failures, always blue, match, and fit keys to be certain there is a minimum of 75 per cent bearing on the sow-block key face. If there is less than 75 per cent, the key should be remachined. An operator who knowingly uses a hammer with less than this minimum bearing surface is inviting expensive trouble.

Key Drive Force Cannot Split Anvil

The force used to drive a sow-block key (the usual taper is 100 to 1) exerts appreciable strain on the anvil, although not enough to split it. There is, however, a physical action which may develop sufficient force to split the anvil. This is the expansion of metal when it is heated. This danger is present when a tightly keyed sow block is heated faster than the anvil. The result can be a compressive loading as high as 18,000 psi for each 100 degrees F. that the sow-block temperature rises. A 200-degree F. increase can result in a 36,000-psi pressure accumulation between the sow block and the anvil (if the anvil does not give under the strain).

Add to these stresses the finishing blow of a 10,000-pound hammer (estimated in the neighborhood of 10,000 tons), and it is easy to have a total stress which could crack the fillet of the sow block. But it is possible to minimize the compressive stresses caused by thermal expansion through improved maintenance and careful operating procedure.

Sow-Block Heating Pays Off

In an effort to equalize thermal stresses, certain hammer installations have heating coils placed in the earth fill around the anvil to keep it warm continually. Some shops apply torches to their anvils to keep them warm when not in operation. Unfortunately, these heating systems do not prevent the sow block from cooling. Thus it is of prime importance that the sow block be heated separately before the key is driven.

The common practice of driving the key tightly before the sow block is thoroughly heated (and fully expanded) is one of the principal sources of hairline strain cracks in the fillet areas of the anvil. Big breaks start from hairlines.

PERIODIC MAINTENANCE CHECK LIST FOR FORGING HAMMERS

Based on One-Shift-A-Day Operation

At Start of Every Shift

1. Check lubricant supply. Check lubricator to feed oil at proper rate.
2. On steam or hot-compressed air hammers, allow twenty to thirty minutes for cylinder and valves to warm to a uniform working temperature.
3. In cold weather, heat billets and pile them between the dies, where they will also warm the ram and the sow block. Also pile hot billets on top of the ram to heat the piston-rod.
4. Check die keys and sow block for tightness after warm-up.
5. Check end gibbs that back up the frames to make sure they are properly secured.
6. Check guide-way surfaces to be sure there is no scoring.
7. When it is necessary to tighten gibbs at beginning of a work shift, check ram temperature carefully and frequently while raising adjusting gibbs on the guides as the ram expands and takes up running clearance.

Every Two Weeks

1. At intervals of two weeks, or whenever dies are changed, be certain the frame legs are standing plumb on the anvil.
2. Check the fit of the frame in the tie-plate.
3. Check the fit of the frame on the anvil at front and back. If slap has developed, a shim of the proper thickness should be rammed in between the taper filler and the wear strip.
4. Check the ram guide for wear, particularly near the bottom of the stroke.
5. When dies are changed, inspect bearing surfaces, die notches, and fillets in the ram and in the sow block for cracks and scratches.
6. Check sow blocks for hollows beaten in by ram impact on the lower die. Grind out shoulders caused by such hollow indentations.

7. Check near the dowel keyway for cracks caused by a poorly fitted dowel or by an excessive number of liners beside a tapered dowel.

Monthly

1. Check bolts, nuts, cotter-pins, springs, and washers. Check nuts or springs which may have seated into the parts on which they bear, because this reduces spring tensions.
2. On a steam hammer check the joints in the valve gear and monkey motion. Repair any joint which has developed slap. Fit new bearings or bushings, or ream out loose linkage holes. Fit each with an oversize pin. Check for steam leaks and repack leaky glands.
3. Inspect anvil for cracks, particularly at the four corners of the sow-block opening and at the fillets of the thrust shoulders on which the frames bear.
4. Wash off all anvil surfaces with kerosene or other solvent and wipe dry. Inspect for cracks. Then recheck in thirty minutes because a crack, at first invisible to the eye, will seep oil. (The oil is more easily seen if the surface is painted with a mixture of whiting in water, after it has been cleaned.)

At Three-Month Intervals

To check the main cylinder of the steam hammer: block the ram at the top of its stroke; remove the cylinder head; jack the ram so that the piston is out of the cylinder. Inspect piston-rings for possible breaks and scoring. Check cylinder walls for scoring.

At Intervals of One Year

When a piston-rod is changed, or at annual intervals, the cylinder walls should be inspected. The bore and the fit of all the valves should be checked.

Check cutting edges of the monkey-motion valve for signs of "wire drawing."

When a hammer is shut down overnight or over a weekend, the sow block cools much faster than the anvil. Usually the latter is protected in a pit, or it may be half-buried in the ground. When work is resumed, the sow block has often shrunk with the cooling. Therefore the sow-block key will be loose. Far too many hammer operators will drive the key tight and then begin

work. The sow block will soak warmth while the bottom die heats; or else the die will absorb heat through contact with the hot steel that is being forged. This heat is absorbed by the sow block.

Each time this cycle is repeated, the stress on the sow-block fillet is increased until the elastic limit of the metal has been exceeded. Here is an ideal situation for the start of a crack.

Do Not Drive a Key in a Cold Sow Block

The obvious cure for this kind of fillet crack is to stop the driving of sow-block keys in cold sow blocks. Few operators comprehend the tremendous power of expanding metal. For example, there is on record an instance in which a sow-block change was necessary one winter when it was nearly zero. The replacement block had been stored in an unheated shed. This block was installed in the hammer, and in order to rush the hammer back into production, the key was driven tight immediately and work was resumed. Within a few minutes the anvil split. Cause of the break was traced to thermal expansion of the sow block.

Failures in Sow Blocks and Dies

Die-blocks and sow blocks are usually made of the same alloy, and thus have the same degree of hardness and toughness. Nevertheless, the die is often beaten into the sow block over a period of time. Care must be taken in the installation of a new die to assure that it is not larger than its predecessor. Also, make sure that it has more bearing surface than only the shoulders of the indentations from the previous die. When there is only the shoulder bearing, the larger die may peen over the shoulder on which it bears to form a lap. A surface lap often starts a crack in the sow block.

When a short die-block is used in a drop-hammer for any length of time, the battering hollows the face of the sow block. Then, when a new, standard-length die-block is installed it will bear only at the ends, over the hollow peened out by the smaller die. Breakage usually results. But casualties can be prevented by grinding away the shoulders that have been extruded around the pit in the sow-block surface. This can be done without taking the sow block out of the anvil.

Failures in Anvils

The most common anvil failure is vertical cracking. The majority of the cases occur in the radii or fillets of the corners of the sow-block opening. These areas should always be polished and all sharp corners rounded. The polishing makes cracks easier to see. Sharp corners are conducive to cracks through stress concentrations.

An excellent aid in anvil maintenance is to polish around the sow-block opening in the anvil. Then a weekly inspection can detect any fracture in its infancy, when it is easier to remove. Good "housekeeping" practices, such as tidiness

and the removal of dirt, oil, and scale, also make it easier to find small cracks starting in the anvil.

Engineered Lubrication

Lubrication, an item of maintenance practiced by all machine operators, can also be a problem around a forging hammer. Operators have a habit of lubricating the guides with the same swab used to lubricate dies. The swab picks up considerable heat scale from the cavities. When used to lubricate the ram guides, some of the scale is almost sure to get onto the bearing surfaces. Since the ram and the guides are steel, the combination of high load, poor lubrication, and abrasive scale materials on these wearing surfaces has about the same effect as using emery as a lubricant. The problem is solved by using separate swabs or else doing away with swabs altogether. Spray guns or metering lubricant dispensers provide a more reliable solution.

Control should also be extended to the prevention of heat scale from other sources being blown about the hammer. Scale is unavoidable, but when the air blast is used to blow scale from the dies it must not lodge in the guide ways.

Lubrication of the flat bearing surfaces between anvil, frame, tie-plate, and cylinder is sometimes neglected until they begin to "powder up" with pinkish-purple oxide. Then the oil-grooves become clogged, belated lubrication is impossible, wear accelerates, and the bearing system of the entire hammer soon needs remachining. Therefore, lubrication should be positively scheduled at required intervals. No equipment should ever be used without lubrication.

Grease cannot be used as a hammer lubricant because under the influence of heat, the grease's soap base chars, causing formation of a hard residue that blocks oil-grooves.

General Safety Precautions

The daily check by the hammer man should include inspection of the equipment for safety's sake. A careful search for loose nuts and broken bolts, springs, or other parts, particularly overhead, eliminates the possibility that falling parts will endanger the smith and other personnel.

By their very nature hammers tend to batter themselves to bits and wear themselves out. Neglect of lubrication cleanliness and simple maintenance accelerates wear and breakage. Hammers will respond to care and regular lubrication with suitable materials by giving extended life and operation reasonably free from scrap, trouble, accidents, and down-time.

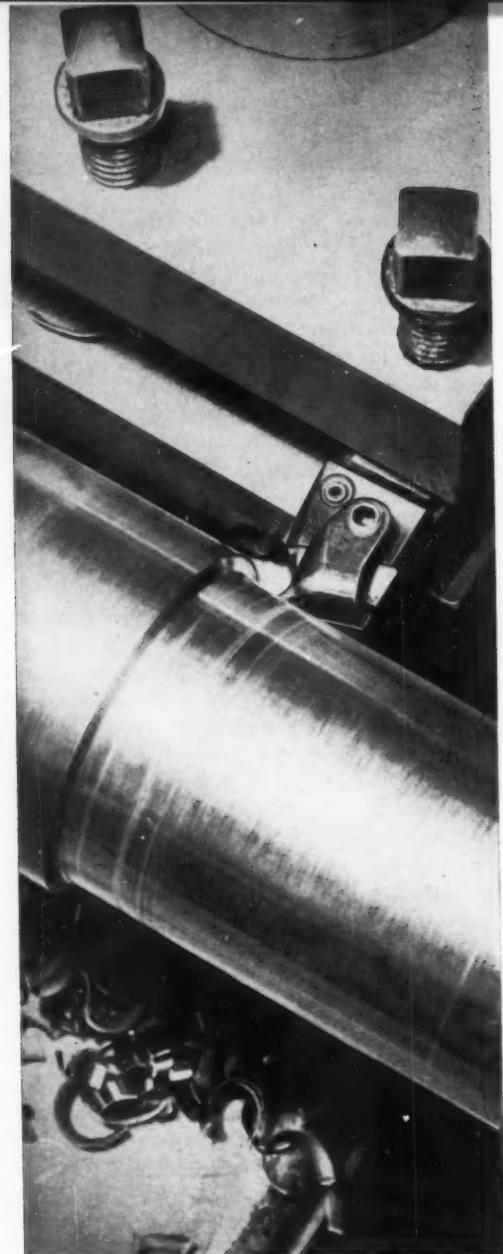
Which tools for turning

brazed,
on-end, or
throw-away?

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THE true test of any tooling setup is: Will it meet all production requirements while resulting in minimum over-all production costs? No longer can simple tool economics or tool life alone indicate the best choice. Selection of turning or facing tools for a specific operation should be made only after many factors have been evaluated—both individually and as they affect each other. The various factors that should be considered before selecting a turning tool are listed in the accompanying table.

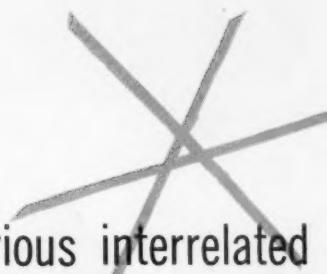
Some plants specify brazed tooling on new jobs to permit experimentation with such tool features as rake angles, lead angles, and radii, and then switch to one of the other types after the best geometry has been determined. This practice is



not as prevalent for turning as it is for milling and boring because more information is available for turning and the initial capital investment in tools and consequent economic risk is less.

The various factors to be considered are not constants. They should be re-evaluated periodically to reflect the over-all effect of advances made in all types of turning and facing tools, particularly those developments concerning the design of throw-away holders.

Turning-tool selection often appears even more difficult than it really is because of the large number of different holder designs now available. However, holder designs, like other selection factors, can be reduced to the common denominator of cost, which makes comparisons easier.



An analysis of how various interrelated factors can influence selection of tools for turning under a wide range of operating conditions

A good example is in an automotive plant where a turning operation was originally performed with a brazed-carbide tool. Later on, this tool was replaced by an on-end insert type holder, and subsequently, by a throw-away carbide insert holder. Each time a change was made, a cost reduction was realized.

Now, this same manufacturer has retooled the same operation with a new on-end holder of changed geometry. Again, costs have been reduced. No mistakes were made either. Factors that influenced over-all costs changed and the manufacturer simply kept up with the changes.

Metal-Removal Rate

Rake angles are the most important design characteristic affecting metal-removal rates of turning tools. When negative-rake tools are compared, there is generally little difference in the performance of properly applied on-end and throw-away tools. This is not so with brazed tools, due to the inherent strains created by brazing.

In terms of metal-removal rate, negative-rake tools compare favorably with positive-rake or combination positive-negative rake tools where work-piece design, material being machined, and available horsepower are not major factors.

Positive-rake or combination positive-negative rake tools, however, do provide freer cutting action and consume less horsepower. These are considerations important in machining such materials as aluminum and where available horsepower is a critical factor.

Positive-rake tools, Fig. 1, generally can operate at relatively high feed and speed rates with minimum cutting pressures. This may be important where the part is likely to distort excessively during machining operations.

Metal-removal rates are not usually the only

criterion. Also, while on some operations cutting-edge life may be longer with positive rakes, there are fewer available cutting edges on specially ground on-end inserts or throw-aways. These factors should be balanced against each other.

Down Time for Tool Changing

Considerably more time is required to change brazed tools than for mechanically held inserts. Brazed tools must be removed and replaced each time the cutting edge becomes dull. In contrast, on-end and throw-away inserts usually need only be indexed (and periodically replaced) without removing their holders from the machine.

Down time for changing throw-aways is less than for on-end types. While throw-away inserts can be simply replaced when all cutting edges are dull, vertical height adjustment is usually required when on-end inserts are replaced in a holder. This difference is exaggerated when a short insert is replaced by a long one, or vice versa. These differences in down time for tool change are magnified in machine setups where a large number of individual turning tools are used.

Since productivity is affected by tool-change time, the cost of tool changes is one of the more important factors to consider before choosing a tool. When tool-change time is considered, throw-away inserts have the advantage.

Grinding Time and Costs

In general, grinding costs are highest for brazed tools because they are usually ground individually. Not only does the carbide have to be ground but the shank relieved at each grinding. The cost of grinding on-end inserts is less for two reasons: (1) there is no shank to back off and (2) inserts may be simultaneously ground

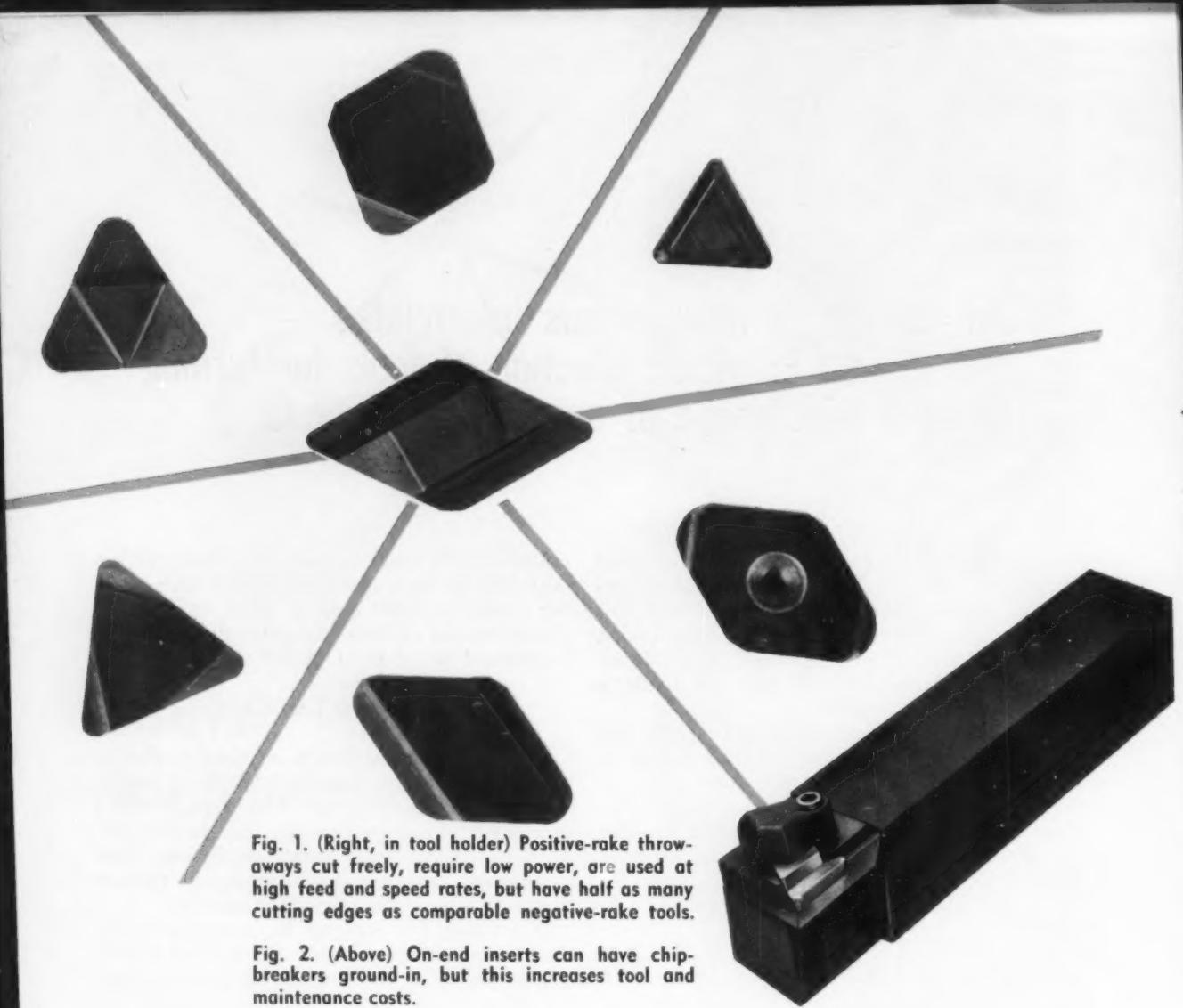


Fig. 1. (Right, in tool holder) Positive-rake throw-aways cut freely, require low power, are used at high feed and speed rates, but have half as many cutting edges as comparable negative-rake tools.

Fig. 2. (Above) On-end inserts can have chip-breakers ground-in, but this increases tool and maintenance costs.

in large quantities. Throw-aways, of course, eliminate grinding cost entirely.

If grinding costs were the only factors influencing tool selection, throw-away inserts would represent the most economical choice. However, these are almost never the only important factors.

Traditionally, grinding departments are heavily loaded. This load can be increased or decreased as the direct result of a tool selection. The capital costs of new equipment and the expenses of hiring, training, and maintaining more skilled grinding-machine operators are properly a part of the costs to be considered when choosing a tool. Costs of floor space and grinding wheels should also be included.

For plants that are introducing carbides for the first time (and there are more of these than one might expect) throw-aways may offer a convincing advantage. Existing equipment, methods, and operators in the grinding department may

be inadequate for consistently good carbide grinding, which is the only result that can be permitted.

Although specifically a characteristic of tool geometry, the grinding load imposed by the use of positive-rake on-end inserts must also be considered with grinding costs. Generally fewer cutting edges are available per grind. However, depending on the application, the increased number of work-pieces produced per cutting edge may compensate for the reduced number of edges. Good tests or reliable experience data for similar operations will be required before this factor can be accurately evaluated.

Another advantage of throw-away tooling is the virtual elimination of ground-in chip-breakers. Most modern throw-away holders (heading illustration) have chip-breakers that can be adjusted to meet cutting requirements. In contrast, both initial and grinding costs of on-end inserts

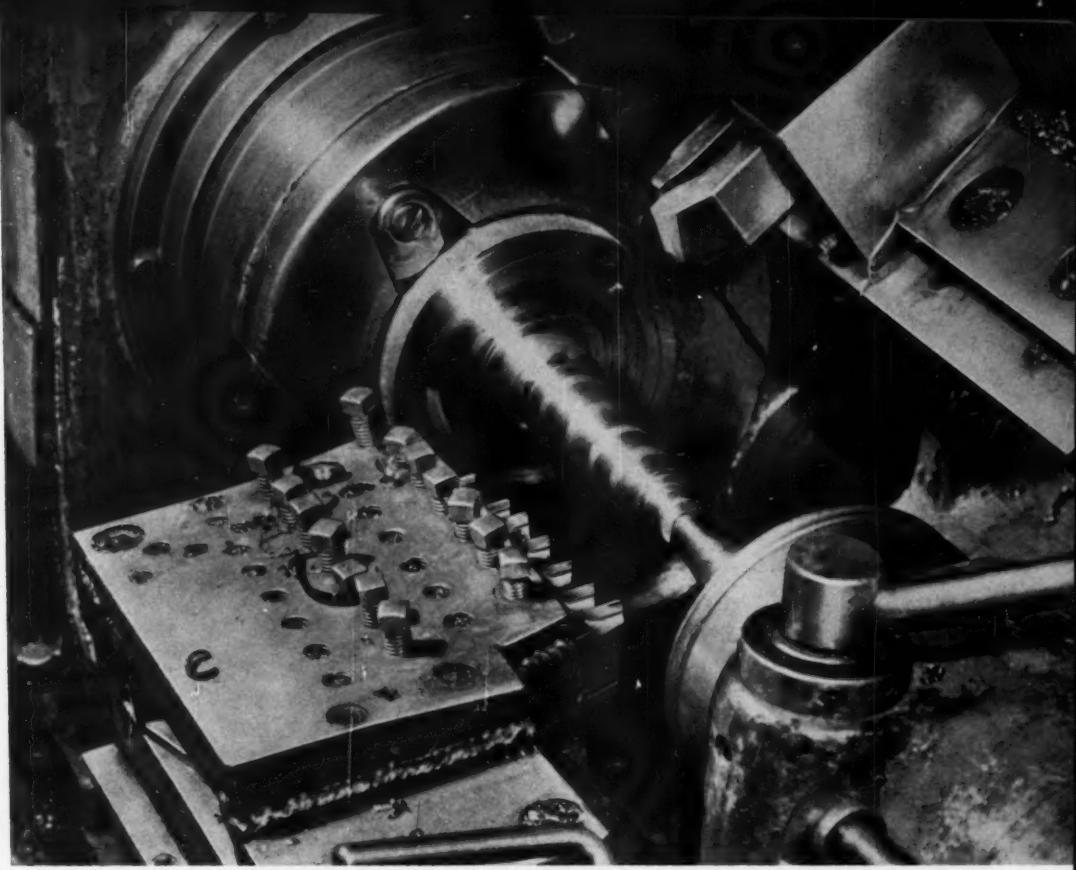


Fig. 3. Brazed tools can be ganged close together, as in this setup for turning alloy stem gears in an automatic lathe.

increase if ground-in chip-breakers are needed, Fig. 2. Chip-breakers are usually called for on steel-turning operations.

Tool-Inventory Costs

Insert type turning tools—either throw-away or on-end—offer considerable savings in inventory costs over brazed tools. Only the inserts need be stocked in sizable quantities. With brazed tools, a considerable “float” of complete tools is required so that there will always be reground replacement tools on hand.

Of the two types of insert holders, the throw-away offers some extra advantages. Although fewer on-end inserts are required for a given production output, a fairly large float is necessary if on-end inserts are to be ground in quantity. Also, the throw-away inserts in inventory can serve as backup for milling and boring, as well as turning tools. This shows how the interlocking tooling relationship among various types of machining operations can influence the selection of turning tools. Since throw-away tool-holders are not usually removed from the machine when changing or indexing inserts, only a minimum inventory of holders is needed.

Throw-away holders have greater end and side

clearances than on-end type holders and are more adaptable for certain operations, further reducing the need for a reserve of holders. Throw-away holders normally used for turning can be employed for facing and boring by angling them in the tool-block. This cannot be done as readily with on-end holders because the heel and adjusting screw extend beneath the tool shank.

There is little difference between the number of spare parts that must be kept in inventory for throw-away or on-end type holders. Considerable effort has been concentrated recently on reducing the number of parts in throw-away holders.

If one tooling design is to be replaced by another, current inventory enters as a consideration. What is the cost of the inventory? How will this inventory be used or salvaged?

Effects of Tool Geometry

The three most important and practical considerations of tool geometry that affect selection from among brazed, on-end and throw-away tools are: (1) rake angles, (2) over-all tool dimensions, and (3) available forms. The determination of whether a tool for a particular application should have negative or positive rake for the best over-all economy requires consideration of a

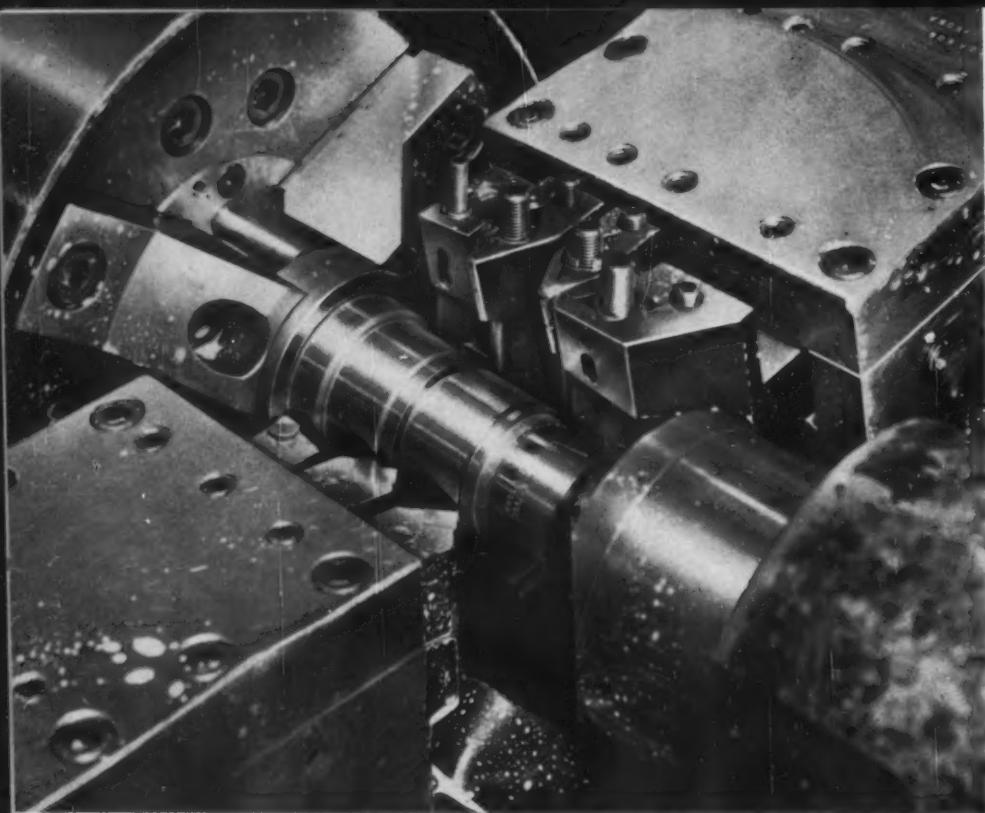


Fig. 4. Here, band type on-end insert holders are being used for turning and grooving of an automatic transmission sun gear. They require more side and end clearance.

combination of factors. These include the following:

- nature of the part;
- material being machined;
- permissible cutting pressure;
- type of machine and condition;
- horsepower available;
- effect on chatter generation;
- cutting speeds and feeds.

Of all these factors probably part design and material to be machined are most important. In cases where the part being machined may tend to distort from cutting pressures, positive-rake throw-away insert holders may offer an advantage. The same holds true where the part is made of aluminum or similar material, which usually requires the freer-cutting action of positive-rake or combination positive- and negative-rake angles, more readily available in throw-away style holders.

From an equipment standpoint, negative-rake tools may improve product quality when operations are done on older machines. Negative rakes compensate for backlash in the machine and are less liable to induce chatter. However, since negative rakes consume approximately 10 per cent more horsepower, the selection of tool style and rake angles must be carefully considered in relation to total available horsepower.

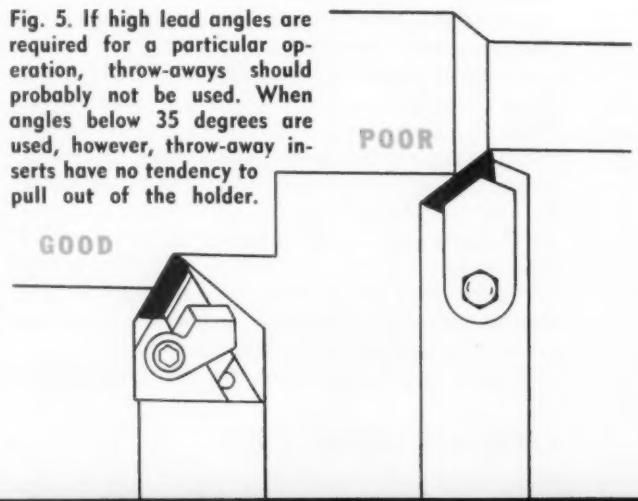
The on-end type holder does not lend itself to

positive rakes without special grinds. Where positive rakes are created by special grinding of on-end inserts, costs are rapidly increased.

Throw-away holders can have positive, negative, or combination rakes. While there is a sacrifice in the number of cutting edges when positive-rake holders and throw-away inserts are used, there may be a compensating gain in the number of pieces produced per cutting edge because of the freer cutting action.

Brazed tools are the most compact. They can be closely ganged, Fig. 3, in multiple-tool setups. The throw-away tool is less compact than brazed

Fig. 5. If high lead angles are required for a particular operation, throw-aways should probably not be used. When angles below 35 degrees are used, however, throw-away inserts have no tendency to pull out of the holder.



tools but does not require as much room as an on-end holder, Fig. 4. This is particularly true with respect to side and end clearance. In fact, the throw-away compares well with the brazed tool in terms of side and end clearance.

Another advantage of throw-away over on-end type holders is that larger inserts can be accommodated without increasing the overhang in front of the tool-block. Tool-blocks can also be maintained closer to the work line with throw-aways than with on-end holders, again reducing overhang and giving a more rigid setup. Brazed tools, of course, are best in this respect.

If conversion of tooling from on-end to throw-away type holders is contemplated, consideration must be given to the possible expense of changing tool-blocks. Certain ASA standard shank dimensions for throw-away holders with adjustable chip-breakers are different from those for the older on-end type holders.

A point to remember when turning cast iron is that high lead angles are desirable. Edge chipping of the part is liable to occur as the tool leaves the cut if the lead angle is too small. In choosing the holder style for such operations, the limitations in permissible lead angle with throw-away insert holders must be considered. Where a lead angle of 35 degrees (Fig. 5) or over is

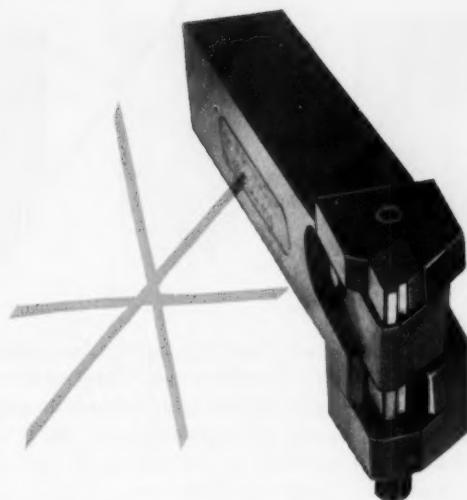


Fig. 6. This on-end holder with specially shaped insert illustrates how the number of cutting edges can be reduced when forms are turned.

required, the tendency for the throw-away insert to pull out of the holder must be considered.

Brazed tools have the advantage where special forms are required. Stock tools can be ground to whatever form is desired. This is not feasible for either throw-away or on-end inserts, although specially shaped inserts of both types (and special holders) are available, Fig. 6, at additional cost.

If a chip-breaker is required, however, throw-away holders, as previously mentioned, have the advantage over other designs. Most throw-away holders include an adjustable chip-breaker, usually made of carbide. Chip-breakers can be ground into on-end inserts, but this may reduce the number of indexes, the number of grinds, or both. If a chip-breaker is needed with a brazed tool, it must be ground in and reground each time the tool is sharpened.

Tool Life

If the same grade of carbide is used in an on-end and throw-away insert holder of identical geometry, there should be no appreciable difference in tool life between the two in any given operation. However, on-end or throw-away insert holders will usually provide longer life than a milled and brazed tool, due to strains created

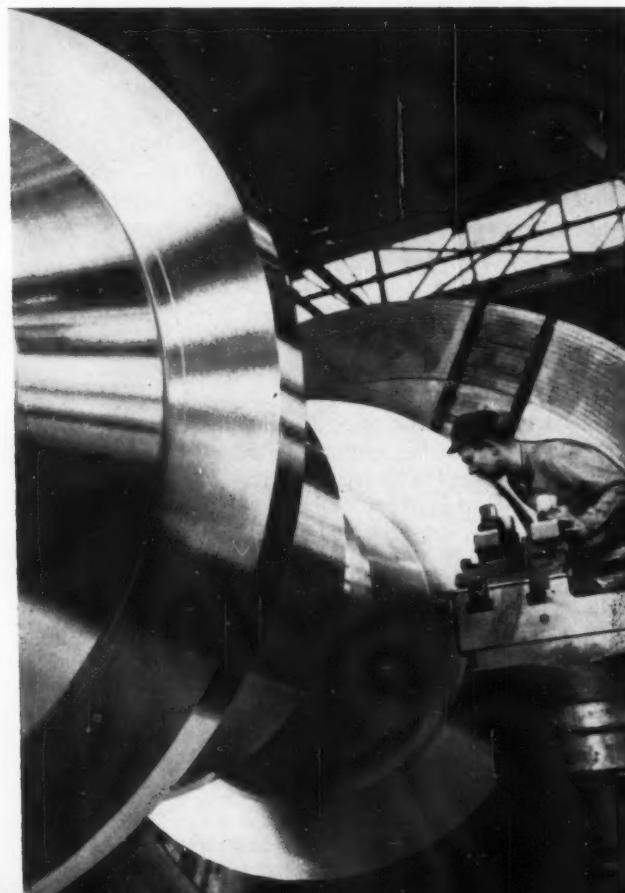
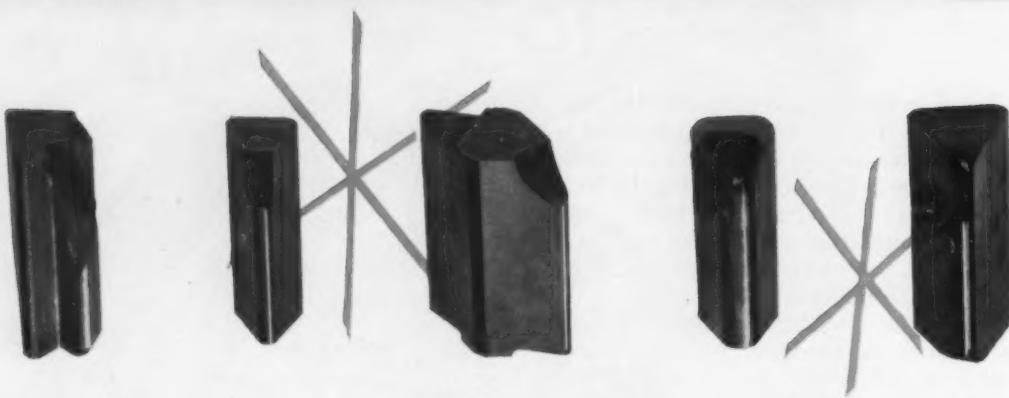


Fig. 7. Not many decisions in selecting the proper tool-holder are as clear-cut as this one. Here, throw-aways would not be heavy enough to do the job. Brazed tools—or on-end inserts, in some cases—would be used for turning this heavy forging.



in brazing. There are, however, operations where throw-aways should not be used. Many of these are operations, Fig. 7, where considerable mass is required for the carbide, tool-holder, or both. Brazed tools or on-end insert holders in some instances are definitely required.

In the field, there are frequent instances where the substitution of throw-away tooling for on-end type tooling has resulted in a significant increase in tool life per cutting edge. Job analysis has revealed, however, that in most cases, the former tools were not properly applied.

Because there is unused life in throw-away inserts after all the corners have been used for turning, many companies are using unworn edges between corners in chamfering operations. This secondary use of the inserts cuts down their cost as turning tools or increases their life, depending on accounting procedures used. In any event, this practice saves money. It is not practical, however, with brazed or on-end type tools because these must usually be reground as soon as possible for reapplication on other turning operations.

Scrap Losses

Scrap losses of two types should be considered—losses of tools or losses of work-pieces in which a certain amount of value has been created by previous operations. Incorrect grinding practices lead to some losses of tools, but where good practices are followed, these losses are low. Grinding practices, of course, are not involved in the use of throw-aways.

Most tool damage results from accidents or poor operating procedures. All three styles can suffer from this type of loss. When on-end inserts shatter in the cut, depending on which style holder is employed, a large portion of the holder is subject to damage, including clamping and insert-support mechanisms. Most important, however, is the fact that a large number of future cutting edges are liable to be lost from the insert, Fig. 8.

With throw-away inserts, cutting edges can be lost on the reverse side if the operator does not

Fig. 8. (Above and top of facing page) Damaged on-end inserts can lose many cutting edges, especially when splintering occurs. Grinding costs to salvage some of these inserts would be prohibitively high.

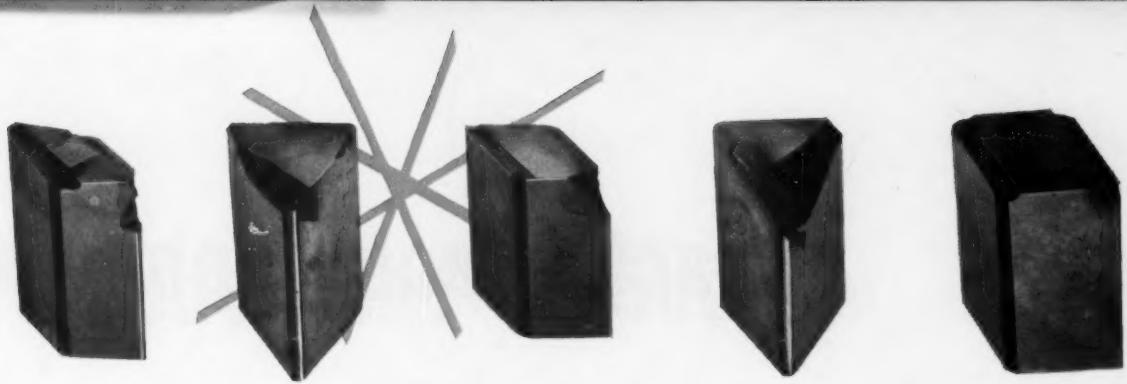
FACTORS TO BE EVALUATED BEFORE SPECIFYING TURNING TOOLS

- Metal-removal rate
- Down time and costs
- Grinding time and costs
- Tool life
- Tool and insert inventory
- Scrap costs
- Tool-geometry factors
- Equipment available
- Initial tool costs
- Part design
- Labor relations
- Finishes required
- Setup time and costs
- Capital costs
- Material to be machined

index the insert soon enough. In a wreck, however, the insert and the replaceable anvil locator absorb the damage and minimize tool losses. In a well-designed throw-away holder, there should be little chance of damage to the holder. Also, relatively few cutting edges are lost even if the throw-away insert is practically new.

Damage to brazed tools due to accidental breakage varies in every instance. The complete tool may have to be scrapped, a new tip may have to be brazed on, or the tool may be returned to use after regrounding.

There is little difference in work scrap rates for the three tool designs if each is properly applied. Scrap resulting from improper insert changing is less likely to occur with throw-aways than with certain on-end holder designs. Throw-away inserts are always on center, whereas height



must usually be adjusted each time an on-end insert is replaced.

Initial Tool Costs

Initial cost of a complete brazed tool is, of course, considerably less than for either a throw-away or on-end type holder. The throw-away holder is somewhat lower in cost than the on-end type. After the tool-holders for inserts have been purchased, however, the tool costs for maintaining them are considerably lower than for brazed tools. Also, if the cost of the insert holder is amortized over its productive life, it reflects additional savings.

On the basis of productivity during its life, the on-end type of insert is somewhat lower in cost than the throw-away. It is higher in upkeep costs, however, since it must be reground and reset. Both on-end and throw-away insert initial costs are lower per operation than milled and brazed tools, since a much larger float of brazed tools is required.

While fewer on-end inserts are required than throw-aways, initial cost of the on-end inserts is greater. Disregarding cost of maintenance, however, on-end insert cost may be somewhat less per part produced than throw-away inserts.

Even where cost of grinding is included, the on-end insert may prove more economical in terms of total production. This must be *carefully* analyzed. It cannot safely be assumed that throw-aways will automatically result in lower tool cost per piece because they eliminate grinding costs.

Another factor that must be considered with initial cost is the possibility of using insert holders to cut different types of materials simply by changing the grade of on-end or throw-away insert. This cannot be done with brazed tools.

Effect of Equipment Condition

When turning with carbides, it is desirable that equipment be rigid and have sufficient horsepower, regardless of the design of tools used. When converting from high-speed steel to carbide on low-power machines, however, positive-rake throw-aways do offer several advantages. They require less power and do not introduce new problems for the grinding department. Depending on the equipment condition, however, negative-rake tools may be desirable to minimize the effects of backlash and reduce chatter.

Although throw-aways have proved highly successful for severe interrupted cuts, on-end in-

(Continued on page 118)

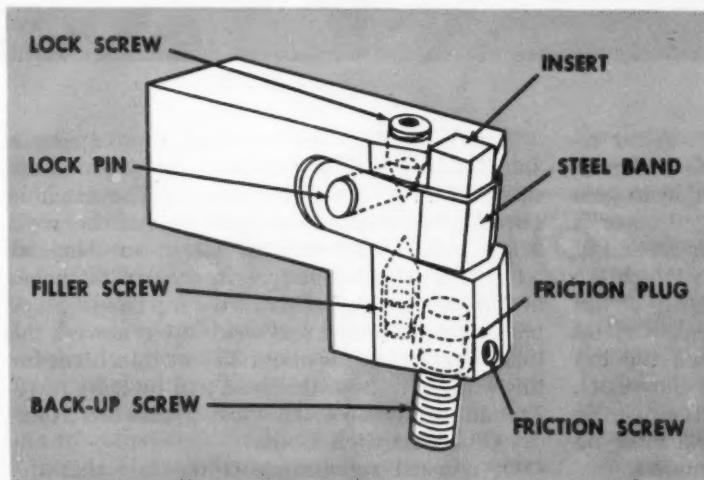
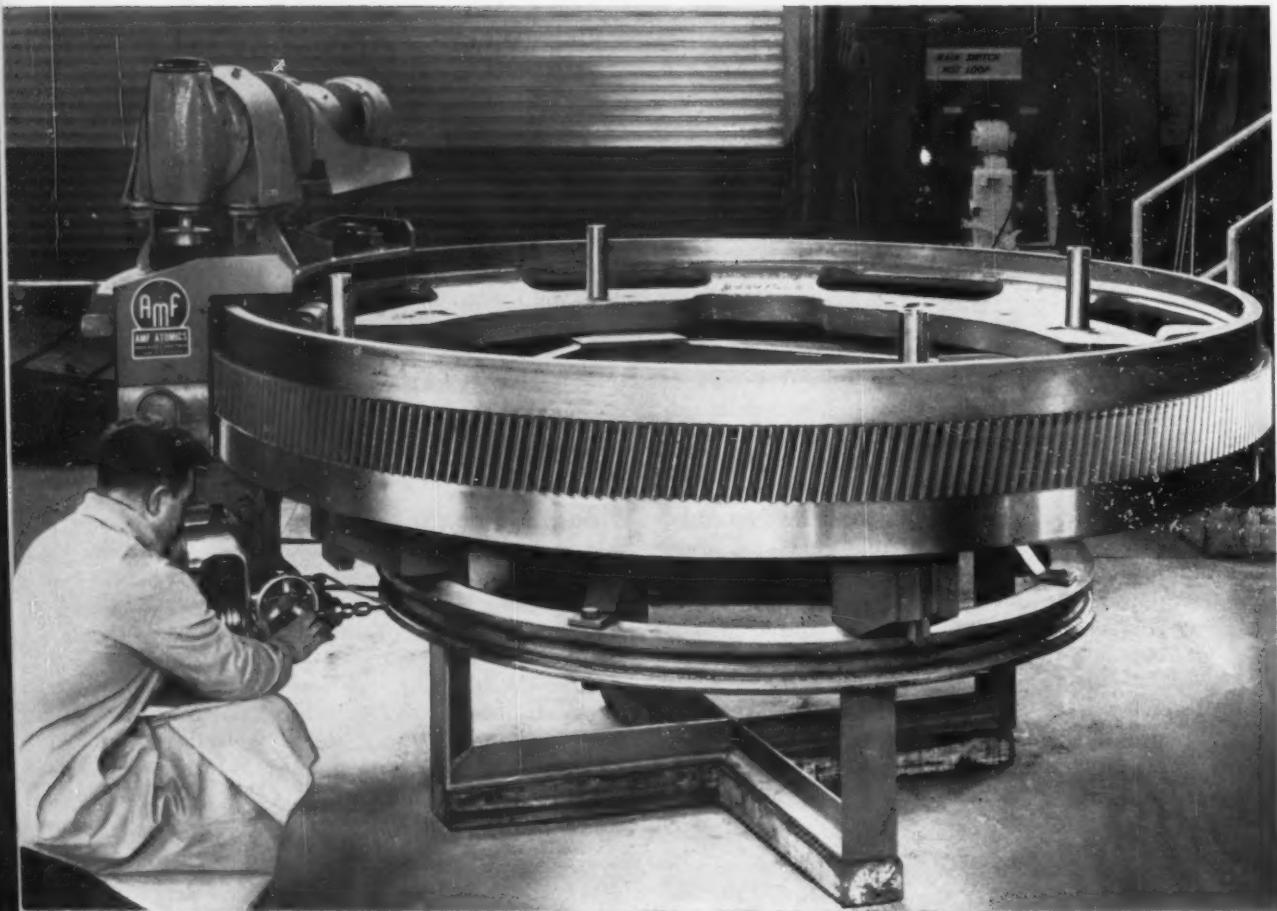


Fig. 9. On-end holders have high rigidity and mass, permit high-pressure clamping, and offer secure seating where severe interrupted cutting is involved.

Reactor-case opener



THE pressure vessel of a nuclear reactor is generally constructed in such a manner that the flanged top cover is removable to gain access to the reactor core. This flanged cover is usually held tightly against the lower section of the vessel by a number of large bolts which are designed to provide mechanical integrity of the flange joint. To ensure a gastight seal, a metal ring is included at the joint between the top flange and the main lower section of the vessel. This U-section metal ring is welded in place. To open the reactor, this welded gas seal must be cut away when the flange bolts are removed.

A cross-section view of a typical seal ring is shown in Fig. 1. The vessel and the seal ring are made of Type 304 stainless steel. The machine (heading illustration) is used to cut the weld beads from a seal ring 67 inches in diameter which closes the reactor pressure vessel, 82 inches in diameter, measured across the top flange. Since both top and bottom seal welds are removed, the total length of cut is about 35 feet. Machines for this work have been designed and built by AMF Atomics, a division of American Machine & Foundry Co., Greenwich, Conn.

Of unusual significance is the fact that the

doubles as welder

The operation of an atomic reactor, just like anything else, requires periodic maintenance. Because of the conditions of high gas pressure and size, special equipment is needed to open and close the seal of the vessel.

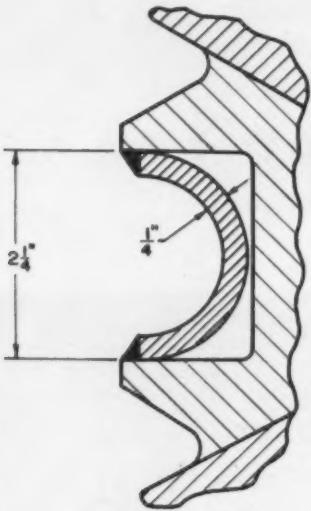
American Machine & Foundry Co. has supplied a seal cutter which can later serve as a weld positioner when the vessel is closed

**P. L. Marjon, Project Engineer
AMF Atomics, a division of
American Machine & Foundry Co.
Greenwich, Conn.**

machine can be converted from a cutter to a semi-automatic welding machine to weld the seal ring into place on the reactor at the time of reassembly. A wide variation in seal-weld diameters may be cut by different-size machines. The present design limit on machine size is about 18 feet. For comparison, a small version of the seal-weld cutter is used to cut the weld beads which seal reactor instrumentation and control-rod ports. The latter machine cuts diameters as small as 2 inches, the cutter arrangement being considerably different from that employed in the large machines.

In the 86-inch flange reactor vessel for which

the illustrated machine is designed, there are certain size restrictions to avoid interference with permanent structure around the vessel. The pressure-vessel installation is shown in Fig. 2. When the machine is being installed on the reactor pressure vessel, it is not possible to ascertain the exact location of the flanges by visual inspection because the weld bead is flush with the edge of the flange. On other reactor pressure vessels, a shelf section is incorporated in the design so that the flanges may be quickly located by direct gaging methods (Fig. 3). For this machine, however, a different mode of approach is necessary. Slots are

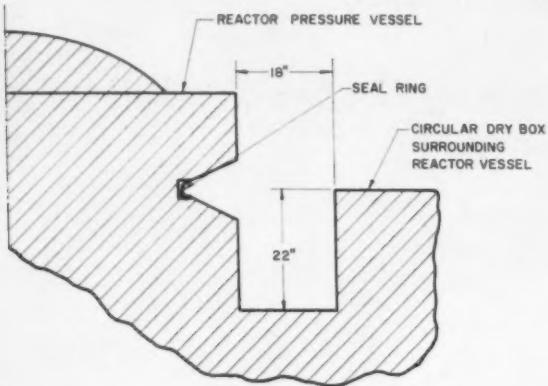


milled in the seal ring so that a mechanical gage can contact the flange face. The location of the flange can thus be quickly determined and the position of the cutter can be adjusted. A reasonable degree of accuracy is required in the positioning of the cutter, since the same flanges are re-used for seal-weld joints. It is important to leave the flanges as close as possible to their original dimensions.

To cut a slot, a two-flute cutter is used to make plunge cuts through the seal ring, and four-flute cutters are used to mill the slots. The gaging slots are made at three different places around the seal-ring periphery at about 120 degrees apart. The slots are made so wide that when the top and bottom weld beads are cut away, the sectors of the seal ring between gaging slots can be lifted from the seal groove. In this manner, the entire seal ring can be removed before the top cover is removed from the reactor. The advantage gained by this procedure is that the flanges can be inspected and gaged. If additional machining is necessary, it can be completed with the cutting machine still installed on the pressure-vessel cover. The operation sequence of removing the seal ring can be accomplished in an eight-hour work day. The cutting of three gaging slots and approximately 35 feet of weld bead are involved, in addition to machine setup, adjustment, and dismounting time.

The machine consists of three major parts: a circular platform which is the body of the machine; a carriage which travels on tracks around the edge of the platform; and a Bridgeport milling head, which is mounted to travel with the carriage, Figs. 4 and 5.

The platform is approximately 8 feet in diameter. It has a precision-machined track section around its periphery on which the carriage moves. The platform fastens to the top of the reactor pressure vessel with clamps. Leveling screws built into the platform align the track and the tool bolts with the pressure-vessel flanges. To facilitate handling, the platform is made in two semicircular sections which can be separated by



SHELF-LIKE
EXTENSIONS
ASSIST IN
CUTTER
ALIGNMENT

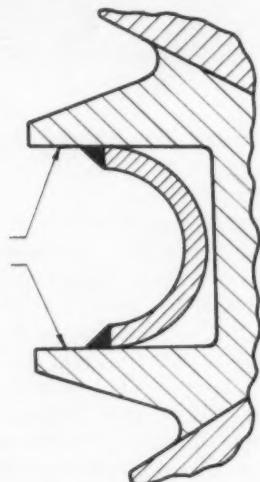


Fig. 1. (Top) Cross section of a reactor seal-ring area, showing the 1/4-inch ring and the welds (solid black triangles) which are milled away to remove the ring from the flanges above and below it.

Fig. 2 (Center) The physical envelope of the miller is limited in size by the cross section of the reactor vessel adjacent to the seal and by the surrounding structure with which it might interfere.

Fig. 3. (Bottom) The weld miller is positioned for the cut by gaging on the flange extensions.

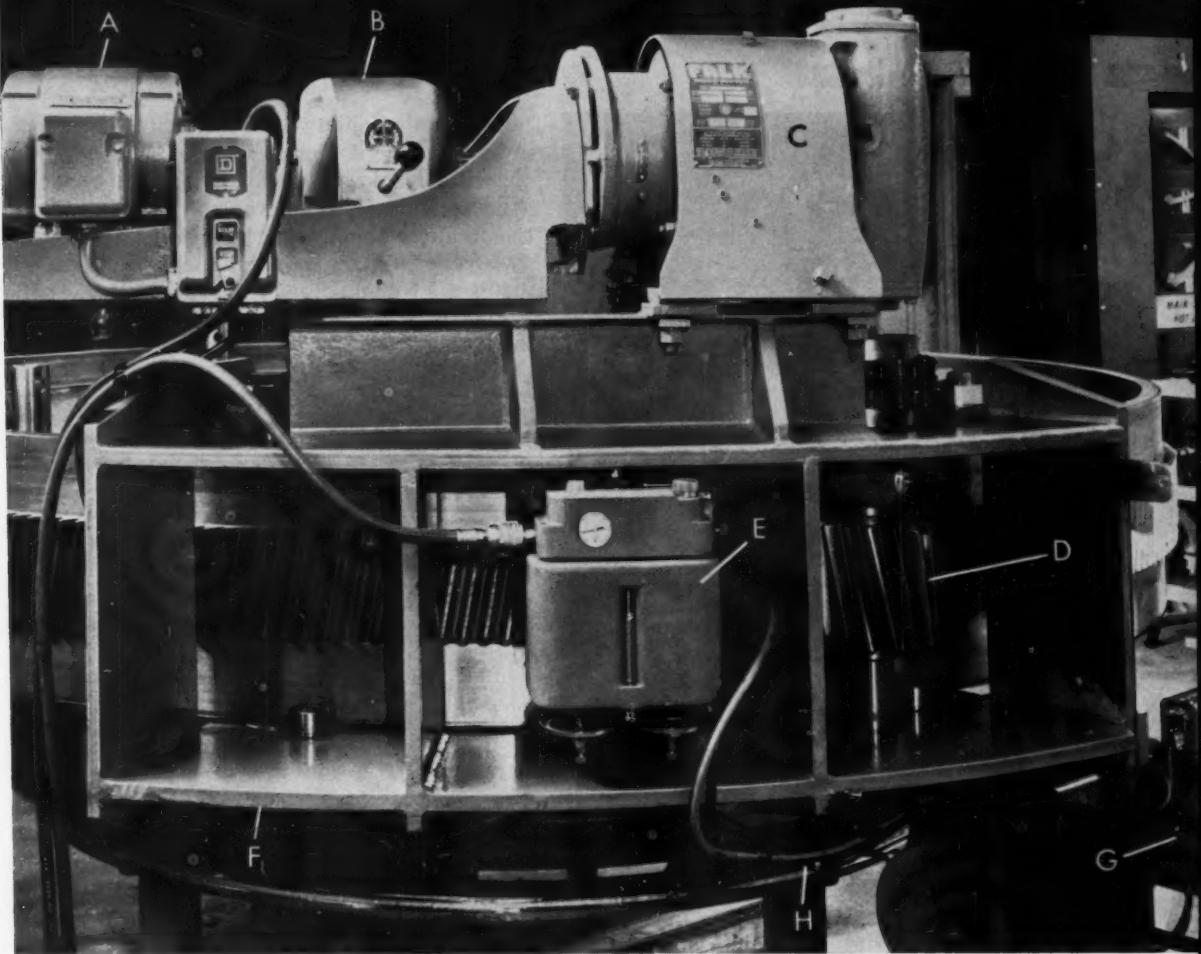


Fig. 4. Carriage and components of the seal-weld cutter showing: (A) motor, (B) speed shift, (C) reducer, (D) drive pinion, (E) mist-coolant reservoir, (F) carriage, (G) cutter-spindle motor, and (H) seal to be cut in order to open the reactor vessel.

loosening the bolts. A helical gear form is machined in the rim of the platform; carriage motion is derived through a pinion, which meshes with this gear form.

The gear-tooth pattern on the platform is a single helical type with 279 teeth, a 10-degree 36-minute 59-second helix angle, a root diameter of 97.52 inches, and a diametral pitch of 2.8387 inches. The helical gear form is employed so that at least two teeth are always in contact with drive-pinion teeth as the carriage feeds around the cut. This condition produces a uniform transmission of drive motion, which is an important factor in producing a cut with maximum efficiency and a minimum of error.

The carriage (to which the traverse rollers, the drive package, and the milling head are all attached) rides around the platform track. Six pairs of opposing rollers contact the cylindrical side surface of the track; two pairs of opposing rollers contact the top and bottom surfaces of the track. All surfaces contacted by rollers are pre-

cision-ground, being, in effect, the bedways of a machine tool rolled into a ring. Drive motion around the platform is transmitted by a 6-inch face pinion which engages the helical gear on the edge of platform, Fig. 4. The pinion has seventeen teeth on a left-hand helix with a pitch diameter of 6.164 inches. The ratio obtained between the gear and pinion is 16.412 to 1. The torque to turn the pinion is derived from an electric motor through a reduction gear.

A 1-hp motor drives a fixed-ratio reduction unit through a four-speed transmission providing changes of 4 to 1, 2 to 1, 1.33 to 1, and 1 to 1. These ratios result in traverse speeds at the cutting tool of 2.6, 5.2, 7.8, and 10.3 ipm, respectively. The fixed reduction unit has a ratio of 1846.93 to 1. The reducer output shaft is coupled to the drive pinion by a roller-chain coupling so that it may be disconnected easily. When the coupling is disconnected, the carriage may be pushed around the track by hand to obtain a rapid traverse motion without cutting.



Fig. 5. On a factory test stand, the seal-weld miller is shown in operating position with the cutter in a simulated weld groove at the lower right.

The cutter assembly consists of a supporting bracket and a milling head. The bracket can be adjusted vertically by a handwheel-driven screw feed. The milling head is a standard machine-shop unit built by Bridgeport Machines, Inc. It includes a spindle, tool-holder, power drive, manual quill feed, quill lock, and micrometer stop graduated in thousandths of an inch. The heat-treated spindle has a No. 2 Morse taper. The collet adapter accepts Weldon shank end mills. The quill is treated by a special chromium casehardening process which gives it a surface hardness one point below that of a diamond. The housing is lapped and precisely fitted to the ground and lapped quill. Quill travel is 3 1/2 inches. The spindle is driven by a V-belt. A heavy-duty 1/2-hp motor drives the spindle at 225, 360, 600, 865, or 1750 rpm.

A mist coolant is used. The fluid reservoir is mounted on the carriage; the spray nozzle is at-

tached to the milling-head assembly. This device is powered by compressed air, controlled by an electric solenoid, wired in parallel with the cutter drive motor so that the coolant air supply is actuated automatically when the cutter motor runs. A valve located on the milling-head housing regulates the volume of mist.

Four carriage speeds are available by shifting the transmission:

Ratio	Inches per Minute at Cutter
1 to 1	10.3
1.33 to 1	7.8
2 to 1	5.2
4 to 1	2.6

Since only 1/2-inch diameter end mills are used, the surface speed of the tool may be computed by the expression:

$$S = 0.13N$$

where:

$$\begin{aligned} S &= \text{cutting speed, fpm} \\ N &= \text{cutter rotation, rpm} \end{aligned}$$

With the five speeds available on the spindle-drive pulley belt arrangement, the following surface speeds are obtained:

RPM	Surface Speed, Inches per Minute
225	29
360	47
600	78
865	112
1750	228

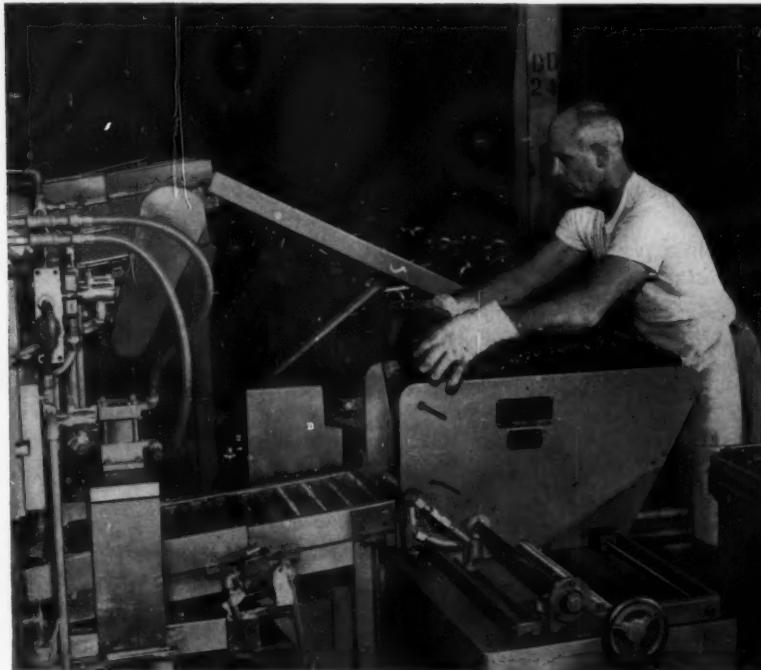
Using mist-cooled, high-speed-steel, four-flute, carbide-impregnated cutters (Brown & Sharpe Mfg. Co. Model 705-131-712), the following speeds were found optimum for seal-ring cutting:

	S FPM	RPM	Feed, Inches per Minute	Depth	Tool Load
A	47	360	2.6	0.375 inch	0.002 inch
B	78	600	2.6	0.250	0.001

The difference in speeds is due to the cross sections of the cuts. A is a triangular cross section of weld-bead material; B is a slot in the seal ring, Fig. 1.

Automated tube former improves washing machine production

One-man operation effects labor savings and yields 4800 flanged tubes per eight-hour shift, doubling the former rate. Loading of a hopper is the only manual operation



**EDWARD DAMSCHRODER, Tool Engineer
Clyde Division, Whirlpool Corporation
Clyde, Ohio**

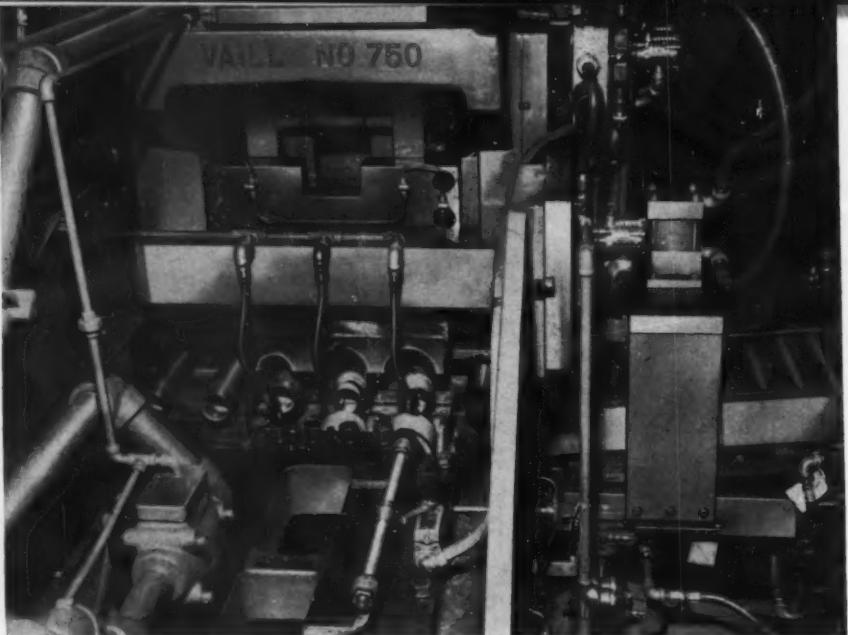
ATOMATIC WASHING MACHINES manufactured for marketing under RCA-Whirlpool and Kenmore names employ perforated steel baskets that are rotated at high speed about a vertical axis during the water extraction cycle. These baskets, produced by the Clyde (Ohio) Division of the Whirlpool Corporation, are each seam-welded at the bottom to the flange of a hollow support post. Recently, a tube-forming machine for making the posts was designed and built by the Vaill Engineering Co. to Whirlpool specifications and put into full operation. Although only one man is required at this machine, it can produce 4800 posts in an eight-hour shift, nearly doubling the former rate. Substantial economies

over the previous method in both labor and steel were affected.

Blanks in the form of tubes 12 3/32 inches long and 2 1/2 inches in diameter, made from 16-gage cold-rolled steel, are purchased cut-to-length and with slightly chamfered ends. After being hand-loaded into a hopper (heading illustration), these tubes are automatically fed via the inclined magazine seen at the right in Fig. 1 to a series of three forming dies. As each tube is fed to the dies, another drops from the hopper into the upper end of the magazine.

Transfer to and through the dies is accomplished by walking beams, the dies being split horizontally. At each station, the tube is gripped

Fig. 1. Tubes are fed one at a time from the inclined magazine (right) onto walking beams that advance them through three dies that form the neck and a rear flange.



in a positive manner by the dies. They form the start of a neck near one end of the tube at the first station and complete it at the second, where a bell shape is also produced. At the third station, a punch feeds into the tube bore from the back and expands the opposite end. This forms a flange against the back face of the die that represents a 60 per cent expansion. Such severe forming occasionally splits the flange, causing a reject, but it is expected that scrap will be held below 0.5 per cent. A punch enters the tube only at the third station.

Between operations the dies are opened by a vertical slide and the work-pieces are advanced automatically one station by the walking beams, which have semicircular recesses to fit the tubes. At the bottom of each recess there is a permanent magnet which prevents displacement of the

work-pieces during transfer. As the walking beams lower, they accurately position a work-piece in each die, including the tube fed in from the magazine.

After forming is finished in the first three stations, the tube is advanced into a mandrel at a fourth work station, shown at the center of Fig. 2. This mandrel, in effect, constitutes a piercing die containing two transverse holes that are aligned with two horizontal punches. Each of these punches pierces a circular hole in the tube wall and pushes the resulting slug into one of the holes in the mandrel. The slugs drop out when the punches are withdrawn and the tube retracts. This completes all die operations on the parts.

When the finished piece is advanced from the fourth station by the walking beams, it is released onto a short inclined chute and deposited on a

conveyor. In this manner, the posts are carried through an automatic washer that removes all oil and foreign matter. They are then delivered, washed and dried, onto the cross conveyor seen in the foreground of Fig. 3. This conveyor, in turn, discharges into another one parallel to the washing machine, returning the completed posts to a point near the loading station. There, the

posts drop into a tote box, ready for transfer to the welder that fastens them to the basket.

The quality of the product is at least equal to that made by the former method, and the savings realized can effect rapid amortization of the new equipment. Total output of the setup is ample to meet the production needs of the two plants in which the automatic washers are assembled.

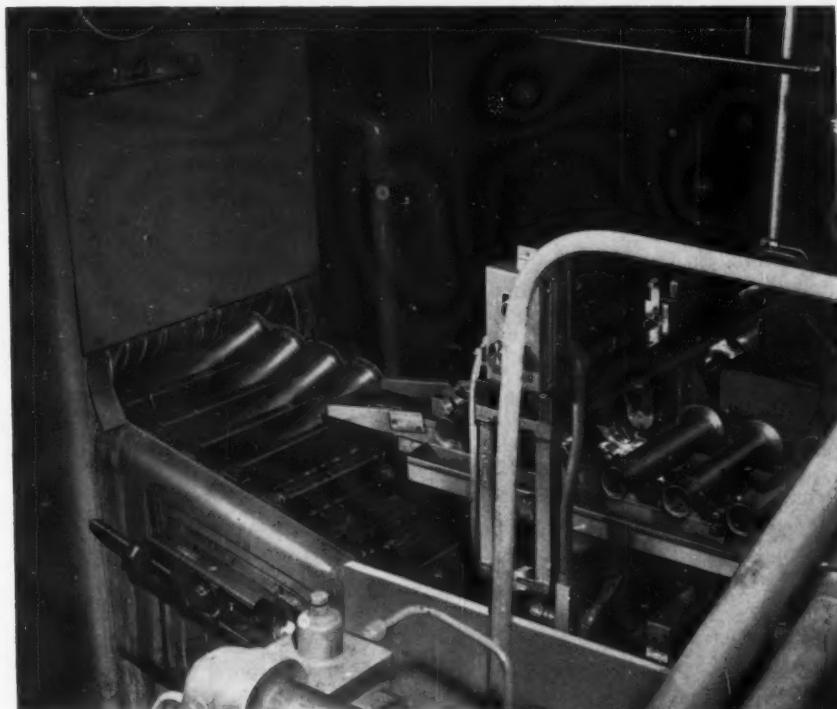


Fig. 2. The walking beams also move the posts to a piercing unit (center), where two holes are produced at opposite sides. Further advance discharges completed posts into the washing machine (left).

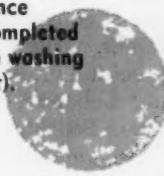
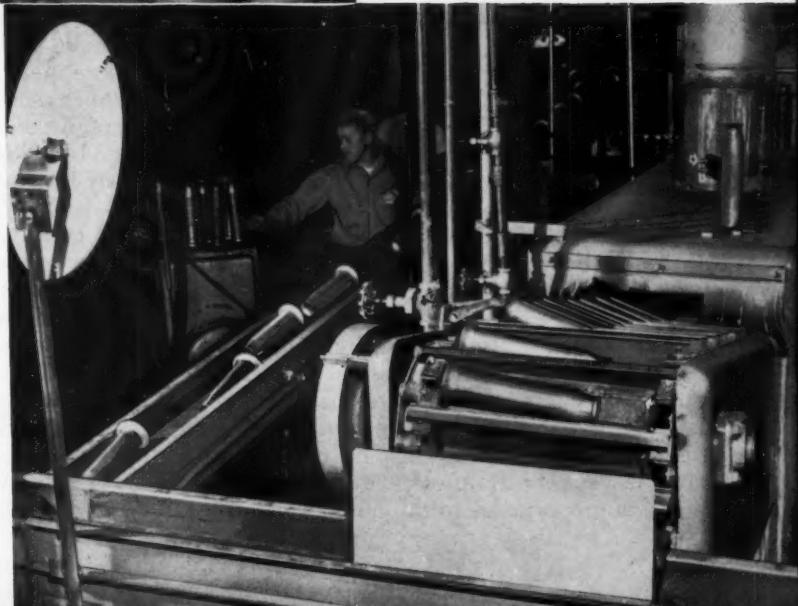


Fig. 3. After washing and drying, the posts are discharged into the cross conveyor (foreground) and then transferred to a second conveyor that carries them to tote boxes near the original loading point.



Fractured-race bearings

A BALL BEARING which has its outer race intentionally split offers the design engineer a new tool for supporting maximum radial loads, in addition to thrust loads from either direction, while maintaining single-row construction. From the outside, this type of bearing looks very much like a conventional one. But internally it is different. Making fractured-race ball bearings in all precision grades is the business of Split Ballbearing, Lebanon, N. H., a division of Miniature Precision Bearings, Inc.

Advantages of these bearings stem directly from the unique fractured-race manufacturing process. Through the simple (and patented) expedient of splitting the outer race, the raceway can be completely filled with balls without the need of a loading slot or counterbore. When a retainer is required, a one-piece precision-machined component of any desired material may be used. Pierced with as many radial holes as the web section between the pockets will allow, a maximum complement of balls can be inserted, usually filling about 90 per cent of the raceway. By comparison, only about 60 per cent of the raceway can be filled when bearings are assembled by the conventional Conrad method, in which the inner race is moved eccentrically against the outer race to permit the insertion of balls. When the maximum number of balls has been loaded by this method the inner race is centered, the balls are spaced out equally and, as a final step, a multiple-piece retainer is inserted to maintain ball spacing.

Because ball bearings made by the split-race technique contain approximately 40 per cent more balls for the same envelope dimensions, they are capable of carrying a proportionally greater load. Static load-carrying capacity of a particular size bearing, calculated by most formulas, is proportional to the number of balls it



Fig. 1. Bearing with one-piece retainer is preferred for low-torque applications.

contains. Dynamic load-carrying capacity is proportional to the number of balls to the two-thirds power.

Since the gain in service life of a bearing is proportional to the cube of the increase in dynamics load-carrying capacity, the increased ball complement will extend this life considerably. An example is an aircraft installation where bearing failure in an auxiliary generator resulted when a 100-per cent overload was imposed on the equipment. Although the bearings were designed for a 1000-hour life, failures often occurred after only thirty hours of service. Corrective action—installing similar type bearings of the next closer tolerance grade, and having a two-piece machined-bronze retainer—did not appreciably extend the operating life.

Split ball bearings were then installed. At first, they were used on only a few generators. After they proved to be satisfactory, the bearings were used on all units in aircraft of that model. Theoretical calculations using conventional ball-bearing formulas showed that the new bearing (with the same approximate external dimensions) had an increase in life of 700 per cent. Under actual

broaden design horizons

tests they operated 1000 hours (using a 100-per cent overload as required by specifications) with no signs of failure. Bearing speeds on the idler gear-shaft were 2000 rpm, and on the generator drive-shaft, 6000 rpm.

Low-Torque Applications

When low torque is important, a large ball complement provides significantly lower starting and running torque under heavy loading applications. The additional number of balls reduces the unit load per ball so that the ball-to-race contact is reduced, permitting a closer approximation to a true rolling surface for any given load.

The maximum ball complement may be used with precision one-piece retainers of bronze, phenolic-impregnated linen (Fig. 1), or stainless steel at high speeds. Where a retainer cannot be used in some of the integrally shielded designs, alternate undersize balls can be inserted in the raceway to allow speeds up to 4000 rpm in most

cases, and as high as 6000 to 8000 rpm in many applications. The conventional method of using springs as separators between balls is limited to low speeds, usually in the order of 50 rpm.

Smaller, Lighter Machines Possible

Often, when the size of a bearing can be reduced, the over-all dimensions and weight of a machine or an assembly can be reduced. Compactness is an asset. Larger-than-necessary size represents an expense to the machine manufacturer during production, handling, and storage.

Such conditions occurred in the design of the hand-operated, air-powered ratchet wrench shown in Fig. 2. Diameter of this tool, manufactured by the Gardner-Denver Co., Quincy, Ill., has been reduced 50 per cent because of the smaller size of the fractured-race ball bearing used. This increased the range of application of these wrenches over that possible with a larger tool.

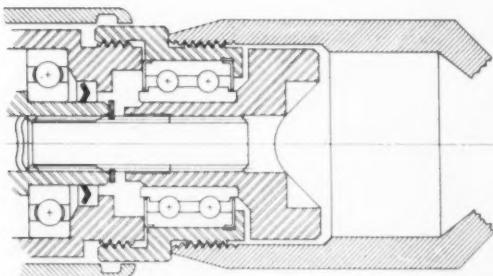


Fig. 2. Size of this pneumatic ratchet wrench (right) was reduced 50 per cent by use of thin-section, fractured-race bearing on internal cam (left).

ASSEMBLING A DOUBLE-RACE SPLIT BALL BEARING

Inner race is inserted in fixture. A full complement of balls for lower raceway is raised and deposited. With the ball-carrier retracted, fractured outer race is added. A full complement of balls is again brought up and allowed to tumble against inner race. Pressure applied to outer race causes fracture to open. The upper row of balls falls into place while the outer race slides over the lower row.



The thin-section bearing permitted Gardner-Denver engineers to maintain the internal cam dimension—a critical part within the tool and upon which the bearing is mounted—while reducing the diameter of the housing. The bearing is a standard precision-ground, thin-section, double-row shielded type. These prelubricated bearings have the same envelope dimensions as standard needle bearings, which could not be used here because of the thrust load involved. The bearing is subjected to a 1000-pound load (radial and thrust) when the pneumatically powered wrench drives a nut to its calibrated torque. Free speed of the tool is 2000 rpm.

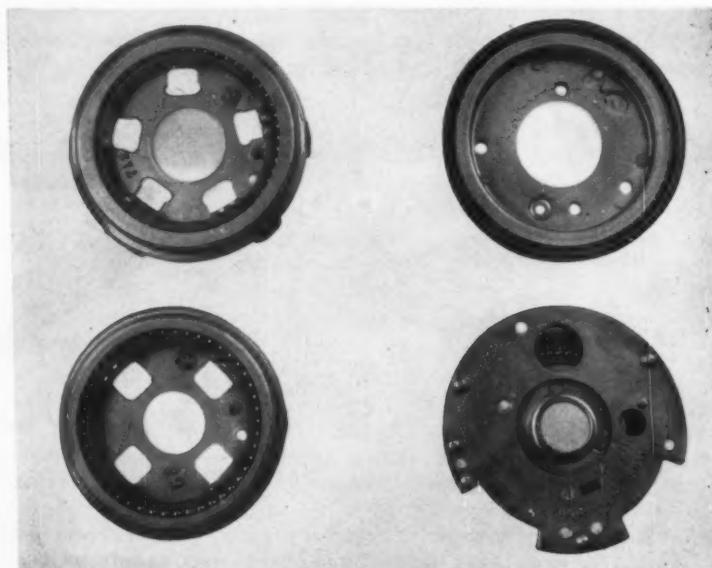
In replacement parts, too, bearings must often be designed to fit within a small area. One group of such parts consists of precision ball-bearing distributor plates intended to replace those used

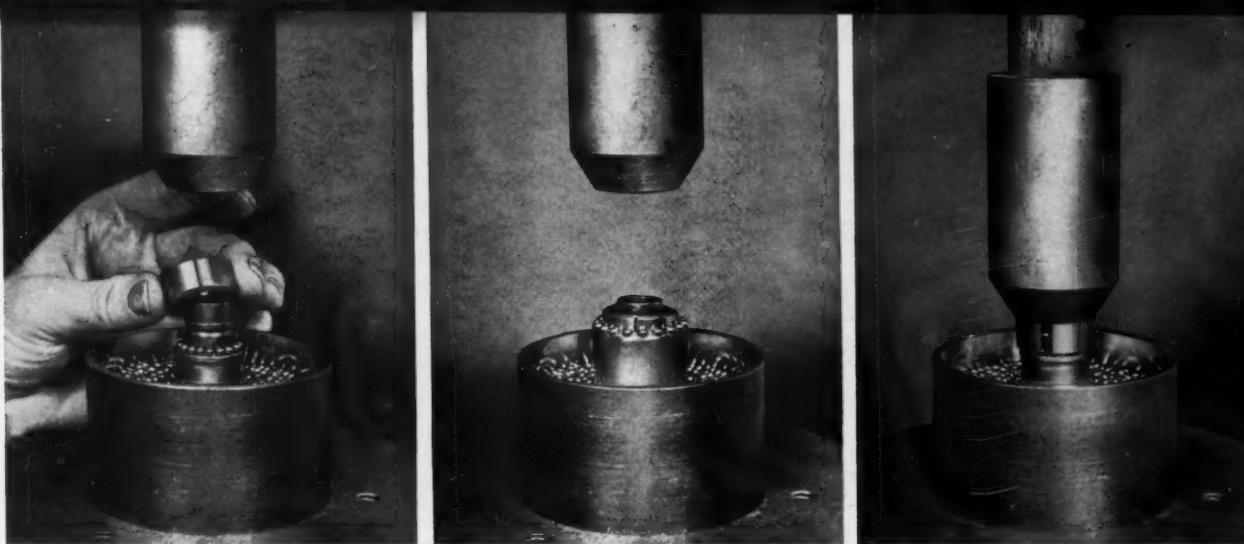
in standard automotive ignition distributors. These Dyna-Flyte units (Renberles Products, Detroit, Mich.) Fig. 3, use a series of thin-section ball bearings of split design. For this installation, bearings are required to have close internal tolerances, in some cases as little as 0.0001 inch. Also, temperature variations are severe—from minus 50 to plus 200 degrees F.—and continuous vibration and shock loads are a part of normal operating environment.

Conditions of Corrosion and High Temperature

When they are to be subjected to corrosive liquids, 440C stainless steel is recommended in the fractured-race bearing. The one-piece retainer can be made from a material inert to the particu-

Fig. 3. Series of Dyna-Flyte replacement automotive distributor plates built around split-race, thin-section ball bearings.





lar chemicals used. Retainers of K-Monel, silicon-iron-bronze, phenolic, and other stainless steels have proved satisfactory for certain applications.

High-temperature operation for auxiliary equipment serving the chemical, process, and aviation industries has become common. For temperatures not exceeding 450 degrees F., no serious difficulties are encountered with conventional 52100 bearing steel. Above this, the split-race technique can be used in materials such as 440C stainless steel and the M series tool steels at temperatures as high as 900 degrees F.

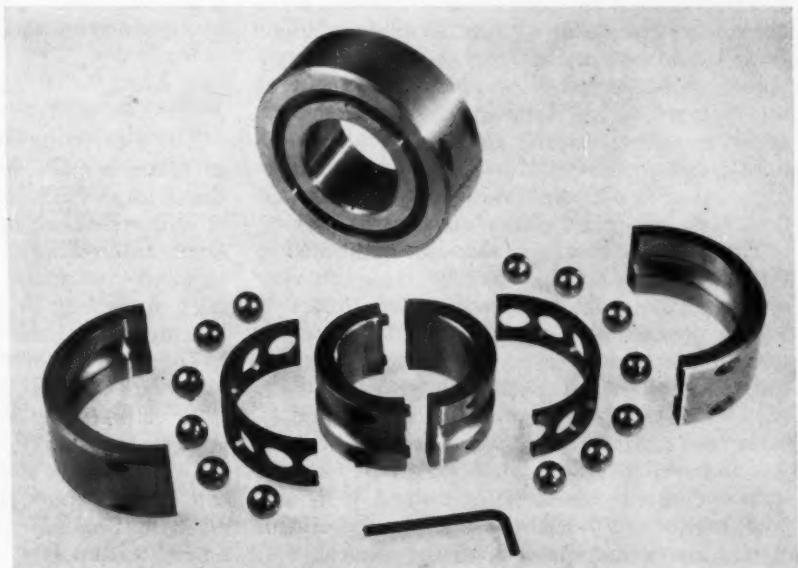
Of course, lubrication is a primary problem at these higher temperatures. When necessary in certain applications, split-race ball bearings can be run dry. However, this will drastically reduce the anticipated life. In some instances dry lubricants have given satisfactory results.

Ball-Bearing Paradox

Contrary to most first impressions, the split race is not a weak point in the bearing. In practice, this type of bearing performs as if there had been no fracture at all. No special considerations are required with regard to mounting or load application (with the possible exception of press-fitting the outer race under heavy thrust conditions with regard to mounting or load application).

When these bearings fail through fatigue, or are intentionally tested to destruction, they fail in ways similar to those of conventional bearings. Of the many theories advanced, one is most commonly accepted. When the outer race is fractured, the resulting break has a series of jagged points, resembling needles or dowels. When the outer race is closed, the jagged edges fit into cor-

Fig. 4. Double-fracture ball bearings such as this can be assembled in places that are inaccessible to solid-race bearings.



responding depressions in the opposite face of the fracture. These hundreds of microscopic dowels restore the former smoothness of the race.

Double-Fracture Split Bearing

In this bearing, Fig. 4, both the inner and outer races are split to permit rapid replacement in machines where the bearings are located in the center of a shaft or crank. The parts are held together with tapered sleeves and screws, and the

entire bearing—including inner race, outer race, retainer, and ball complement—is easily assembled around the required mounting surface. Their major drawback, however, is cost, as considerably more work is required to manufacture them.

Double-fracture bearings can be loaded with a full complement of balls and used in designs which would be difficult, or impossible, using conventional bearings. These bearings can also be used as pillow blocks with the outer race combined as part of the machine.

Which Tools for Turning— Brazed, On-End, or Throw-Away?

(Continued from page 105)

serts can be better if machines are lacking in rigidity. The on-end type holder, Fig. 9, has more rigidity and mass, and permits high-pressure clamping and more secure seating for the heavier cuts. If good grinding equipment is not available, throw-aways should be chosen.

Hints on Good Machining

Although no universal rule is applicable, on-end holders usually have better resistance to impact than the thinner throw-away inserts or brazed tools. They have an advantage for extreme, interrupted roughing cuts. However, if the nature of the operation would cause occasional breaking of the carbide, throw-aways might be more economical. A broken throw-away costs less (in cutting edges) than a deeply slivered 1 1/2-inch insert.

Throw-aways are sometimes preferred where extremely heavy edge wear is encountered. Such wear would reduce the number of grinds available from either brazed tools or on-end inserts, but does not affect throw-aways. Also, where a great amount of turning and chamfering operations are performed, it is possible to get chamfering edges "free" from throw-away inserts that have been completely "used" in turning.

This practice, however, need not be limited to throw-away inserts. The same practice can very economically be employed with on-end inserts if a larger float of these inserts is carried in the plant to maintain turning-tool holders while worn inserts from these operations are being used on chamfering operations before being reground.

For certain grooving operations, brazed tools are preferred over throw-aways. In fact, many such operations cannot be performed with any other tool type. For shallow grooving operations, on-end inserts may prove more economical.

Plunge cutting of forms is similar to grooving. Here, also, brazed tools are most economical. The reason is the same: lower cost for producing the special form in the tool.

For finishing operations on thin-wall parts, such as tubing, either brazed tools or throw-aways with positive rakes are generally preferred. Negative-rake throw-aways and on-end holders may tend to distort the part during machining. For other types of components, the type of tooling makes little difference because they all impart the same finish under the same conditions.

In tracer-turning or contouring, or for operations where a large depth of cut requires a large lead angle, consideration must be given to the question: Will the insert tend to pull out? This is primarily of importance with throw-away tooling and should be anticipated. There are, however, standard throw-away holders which use 55-degree diamond-shaped inserts that minimize such problems when tracer-turning.

Summary

There are many factors to be considered before a choice is made between brazed, on-end, and throw-away tools, but if they are considered one at a time for each operation, selection is not difficult. Interrelationships among the several factors and the various turning (and other machining) operations in a plant should also have a bearing on the choice.

There is a wealth of data on turning operations with tools of each of the three types, available from carbide-tool companies and their field engineers. Where little experience exists on a special operation or material, a simple cutting test can quickly show the tooling system that will result in minimum production expense and optimum efficiency.



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THINKING WITH MANAGEMENT

PROOF OF CAPABILITY

To obtain government contract work it is essential to establish proof of capability. In the missile and aircraft industries, for example, contractors and subcontractors must periodically submit to a penetrating audit of every phase of their organization and operations to hold their ratings as bidders.

The climate of all manufacturing has changed to meet quality assurance standards. Even in non-defense items such as automobiles and appliances the more progressive firms are extending guarantees and warranties in order to overcome competition and improve their reputations. They want to be known as capable of making reliable products that will give longer service. This is better, more economical business, on any level.

Good intentions in such situations have no real value. It is only the ability to comply with warranty and contract specifications, that has any real value. Both industrial buyers and the government use certified bidder lists that establish proof of capability.

Whether you are establishing proof of capability for your own firm or else determining the proof of capability of another firm, the following business areas must be investigated:

Management. Corporate Board, general operating management, and functional management.

Financial. Capitalization, working capital, liquidity, credit, availability of capital, financial policies, and financial structure.

Technical and professional manpower. Project leaders, tool, manufacturing and liaison engineers, technicians, test engineers, trouble shooters actually on the payroll, and union relations.

Technical facilities. Equipment, test facilities, library, and computing equipment.

Production facilities. Equipment, inspection facilities, product testing facilities, standardization laboratories, condition of plant and equipment, and physical location as to transportation and raw materials.

Production. Systems for production planning and control, material control, cost control, plant layout, material handling, manufacturing standards, labor standards, inventory control, production supervision, and packaging cost reduction systems.

Reliability and quality control—the measurable reliability of a product or system is a combination of engineering and manufacturing. In the manufacturing area, reliability and quality control encompass such items as test equipment maintenance, calibration equipment, calibration systems and procedures, a quality control manual (preferably one that has been approved by one of the armed services), and an understanding that the quality of the product from a manufacturing viewpoint is made up of (1) inspection, (2) quality control, and (3) quality assurance.

The exploration of each of the above areas requires a thorough audit of the company—from top to bottom. A contractor should be looking for companies with adequate resources having past records of supplying high-quality technical services and products, and with the record of supplying equipment and services *on time* at a reasonable cost. It will require a check of engineering progress reports on previous jobs.

Such an examination of your own company will provide many benefits for the simple reason that you may discover existing strengths and weaknesses. Furthermore, the sooner you determine serious weaknesses, the sooner you can take action to correct them. Exactly the same concepts apply to any company that you may be examining from a proof-of-capability viewpoint. Even if you are not looking for certification it is advisable to make such an audit periodically. Chances are that your competitors have already established a capability rating.

**Missile-Master lathe
is geared for aircraft
jobs—large parts
at relatively light cuts—
and has dual tracers.**

Large Lathe Simplifies Problems

THE first part which was run on a new lathe installed at McDonnell Aircraft Corporation, St. Louis, Mo., was a convex form for a fixture to be used in making laminations for the Project Mercury space capsule. This part was contour-turned, using the machine's face-tracer attachment. Designed in keeping with United States Government specifications, the Sidney "Missile-Master" has dual tracer controls, one for facing and the other for contouring along the axis of work held on centers. It features a 25-hp, variable-speed drive with control of the spindle speeds at the operator's station. What makes this machine unusually well-adapted for aircraft work is that it combines large-swing capacity and medium-to-light metal-removal rates, for large diameters and light cuts.

Center-distance capacity is 228 inches. Swing over the bed is 76 inches, and swing over the compound is 50 inches. In keeping with specifications, the lathe is designed to remove metal at rates up to 100 cubic inches per minute. It has a standard range of spindle speeds from 2.5 to 400 rpm, with the rate infinitely variable from 0 to 400 rpm. The 54-inch carriage bearing on the lathe's bed and the 18-inch carriage bridge width permit unusual rigidity and maximum tool support in cutting large pieces.

Combining variable rate with four-way, power rapid traverse, the carriage offers precise, simple control. Under power feed, the carriage is fully protected against jamming. Safety devices such as

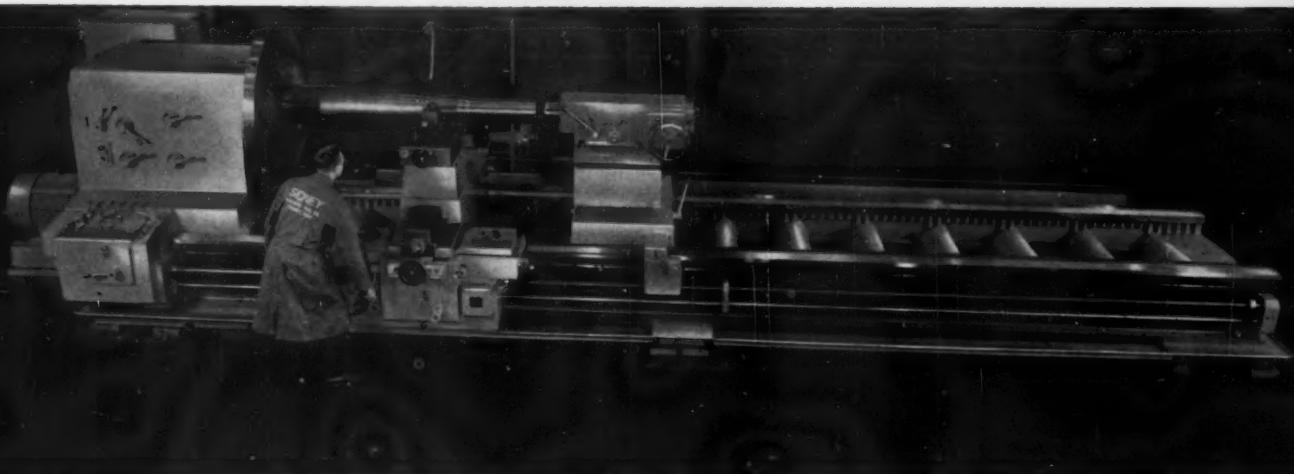
an electric clutch and pressure release mechanisms prevent apron damage should the operator accidentally run the carriage into an obstruction other than intentional.

The carriage compound supplies essential rigidity to heavy cutting operations through the full-bridge-width design of its compound, its all-steel construction, its hardened and ground T-slot area, and its square swivel.

The apron provides combination feed-and-transverse control, plus independent cross-feed and longitudinal-feed controls, placed for operator convenience. In addition, precision, no-stick jaw feed clutches assure accurate, even, and instant response to the controls. The worm-gear drive for feeds provides smooth power and cutting precision. Feeds may be separate or synchronized to give complete versatility to an operation. The apron includes total enclosure of mechanisms in a one-piece housing to assure shaft alignment, automatic lubrication to all movements, SAE involute splines throughout, hardened and ground rack pinion, all gears hardened and shaved, and a length read-out dial with memory clips. A tachometer at the carriage gives the operator full view of the continuous control of spindle-speed changes.

The lathe's headstock has hardened and ground or shaved gears and antifriction construction. Also, it has SAE involute splines and automatic, metered spray lubrication.

Similarly, the lathe's end gearing, enclosed in



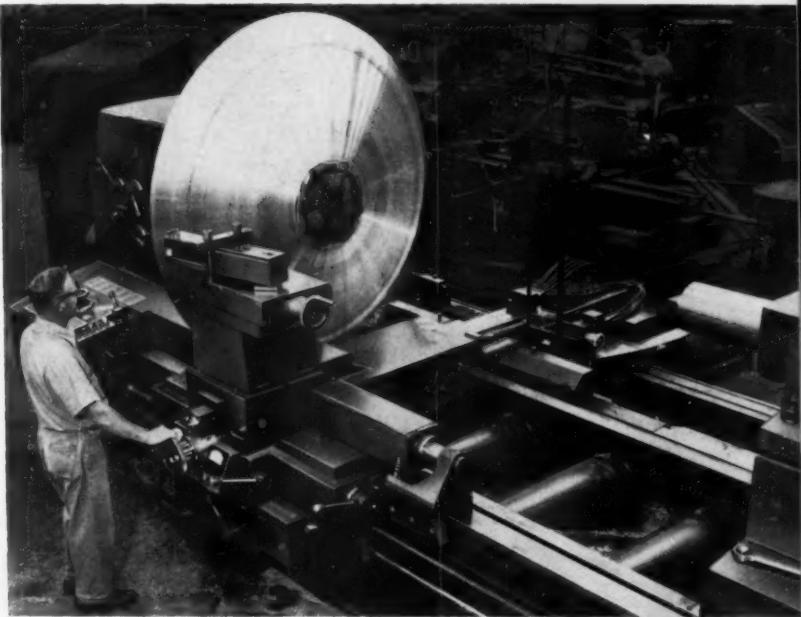
of Aircraft and Missile Builder

a cast housing and automatically lubricated, is antifriction throughout, with all gears hardened and shaved. The 1-to-1 end-gear ratio permits conversion from English to special or metric leads.

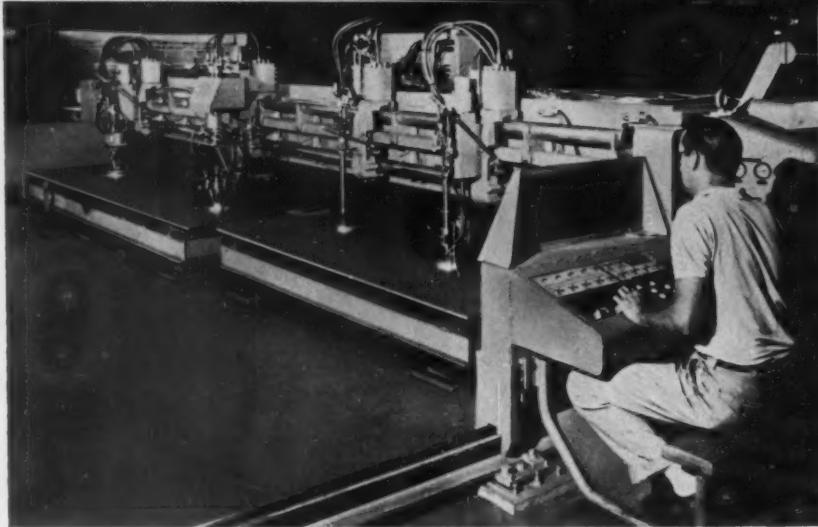
The gear-box has a dual-cam tumbler lock to prevent gear and cone-gear disengagement dur-

ing heavy feeds. With antifriction bearings throughout and with automatic, filtered lubrication, the gear-box offers a wide variety of threads and feeds. A tag on top of the gear-box enables direct reading of feeds and threads from a table. This easy, visual access permits the operator greater ease in setting dial and lever controls.

Dual tracer controls on Sidney's
Model 7650 lathe turn
forms by facing or longitudinal cuts.



Flame-Cutting Goes Numerical



FLAME-CUTTING and tape control have been united for the first time in a machine developed by Air Reduction Sales Co. in cooperation with General Electric Co. Templates, template tables, and reliance on operator control are eliminated.

The Tape-O-Graph is capable of cutting straight lines and contours in plates of any length, 22 feet in width, and up to 6 inches in thickness. It is especially suited for use in shipyards and by large and medium-size fabricators, such as manufacturers of earth-moving and electrical equipment, farm machinery, and railway cars and locomotives.

Fully automatic control of flame-cutting operations is provided by means of numerically coded instructions. Under this system, the part to be cut is designed and engineering drawings

are prepared. Program information extracted from the drawings is punched on eight-channel paper tape.

After initial manual positioning of the machine, all operations are fully controlled by the input data contained on the tape. In addition, auxiliary functions such as starting and stopping the machine, igniting the preheat flames, flame control, gas supply control, and cut sequence are programmed. Cutting speeds are also controlled by the tape within the limits of 2 to 35 ipm. A fast-traverse speed for positioning between cuts—up to 150 ipm—can be included. The unit is equipped with four cutting torches and has a claimed accuracy of plus or minus 1/64 inch.

The Mark Century system that directs the Airco flame cutter is a static, "second-generation" type which is new in design, construction, and appearance, and is advanced in capability. It is necessary to program into the control only that information which usually appears directly on the drawings. For straight-line movements the coordinates of the line and information relative to the velocity along the line are programmed. In the case of arcs, the starting angle condition and radius are also programmed. Internal digital computer circuits of the control use this data to generate a continuous path.

Solid-state devices are used throughout the control. Logic elements are mounted on plug-in printed-circuit-board modules for ease of replacement and repair. To permit operation independent of factory or shipyard environment, the control is sealed and air conditioned.



Fig. 1. (Above) Under the watchful eye of operator, tape-controlled flame-cutting machine automatically slices through steel plate. Each side of the machine is driven by a separate gearmotor connected by a servo-tie system to avoid skewing.

Fig. 2. (Left) Punched tape containing data for flame-cutting operation is being inserted into Mark Century numerical contour control system. Two basic types of information are included on the tape: numerical data for determining part shape, and auxiliary-function data.

MACHINERY'S

Reference Section

How to Evaluate the Effects of Spline Misalignments on—

- **Interference Between Mating Splines**
- **Accurate Transmission of Motion**
- **Optimum Length of Engagement**
- **Beam Strength of Teeth**
- **Wear Loads on Teeth**
- **Load Capacity of Spline**

EARLE BUCKINGHAM

PART 2

SEPTEMBER 1961

How to Evaluate the Effects of Spline Misalignments

EARLE BUCKINGHAM

In this two-part Reference Section the author presents simplified procedures for analyzing and calculating the various effects of misalignments on straight and crowned splines. Tables of comparative data have also been provided that show the effects of changing the number of teeth, material hardness, and misalignment angle. Following is the second and final installment, which introduces the subject of crowned splines.

WHEN the externally splined shaft member is crowned, the contact conditions are changed materially from those on straight splines. The intersection profile of the teeth of the crowned spline with a concentric cylinder becomes a curved form which engages the generally straight-line element of the space of the mating member. The contact between them becomes a straight line, from crest to root of the spline tooth, in the plane of rotation of the shaft member. With these conditions, there are now three possible load-limiting factors: the torsional strength of the shaft, the beam strength of the spline teeth, and the surface endurance load limit value of the materials for line contact between a straight and a curved surface. For any given application, the lowest of these values should be used if failure is to be avoided.

With the crowned spline, there are two driving teeth in the same plane of rotation of the shaft member at 180 degrees from each other. This requires its own method of numbering the teeth, as shown in Fig. 5. The driving teeth are numbered 0, and the teeth adjacent to the driving teeth are numbered 1, 2, etc., as shown.

The same splines as before will be used as examples. The face width of the spline on the shaft will be equal to one-quarter of the pitch diameter of the spline. The center of the radius of the crowning will be at the axis of the shaft, as shown in Fig. 6.

Positions of Driving Teeth and Clearances

For the crowned spline, the equation for the value of the clearances is as follows:

$$-C = R_1 (1 - \cos \Delta) \cos \theta \sin (\theta - \phi) \quad (10)$$

when

- Δ = angle of misalignment;
- ϕ = angle of spline at middle (pressure angle of involute spline);
- θ = vectorial angle of center line of tooth, measured from the hinge of misalignment;
- R_1 = radius to middle of spline, inches;
- C = clearance between teeth of spline. (When the value of C is minus, then there is interference);
- C_1 = corrected value of clearance when that on driving spline is zero.

When the values of R_1 , Δ , and ϕ are fixed, and the values of C and θ are variable, then the value of $(dC/d\theta)$ gives the rate of variation in the value of the clearances. When this value is equal to zero, then the clearance is at a maximum or minimum value.

$dC/d\theta = R_1 (1 - \cos \Delta) [\cos \theta \cos (\theta - \phi) - \sin \theta \sin (\theta - \phi)]$
This expression reduces to the following:

$$dC/d\theta = R_1 (1 - \cos \Delta) \cos (2\theta - \phi) \quad (11)$$

when

$$dC/d\theta = 0, \cos (2\theta - \phi) = 0, \text{ and } (2\theta - \phi) = 90^\circ \text{ and } 270^\circ;$$

and when

$$\phi = 30^\circ, 2\theta = 120^\circ \text{ and } 300^\circ, \text{ and } \theta = 60^\circ \text{ and } 150^\circ.$$

One of these last angles is the position of one of the drivers, and the other angle, at 90 degrees from the first, is the position of one of the teeth with the maximum clearance.

When the direction of rotation of the splines is reversed, the positions of the driving teeth will be at the positions of maximum clearance occupied with the original direction of rotation.

Using the foregoing equations, the clearances on the several 2-inch diameter splines of eight, sixteen, and thirty-two teeth for the several misalignment angles have been computed and are listed in Table 6. The same misalignment angles as before have been used, and in addition, values for 1.00 and 2.00 degrees have been added.

Radius of Curvature of Crowned-Spline Teeth

The radius of curvature of the teeth of the crowned spline in the axial direction must be determined in order to establish the limiting tooth load to resist surface fatigue and excessive wear.

When

R_c = radius of curvature of intersection of crowned spline with concentric cylinder at the pitch radius R_1 , inches;

R_1 = pitch radius of spline, inches;

ϕ = pressure angle at R_1

then

$$R_c = R_1 / \tan \phi \quad (12)$$

For the 2-inch diameter spline,

$$R_c = 1.000 / \tan \phi = \cot \phi = 1.73205 \text{ inches}$$

Limiting Wear Load

The limiting wear load, per inch of contact depth, or per inch of depth of engagement of mating splines, is given by the following, where:

W_w = limiting load per inch of contact length, pounds;

R_c = radius of curvature of contacting surface, inches;

K = limiting load-stress value for the combination of materials (established by experiment from surface fatigue tests).

$$W_w = 2 R_c K \quad (13)$$

For the same steel as has been used before, 225 Bhn, the value of K is 1181. With steels of

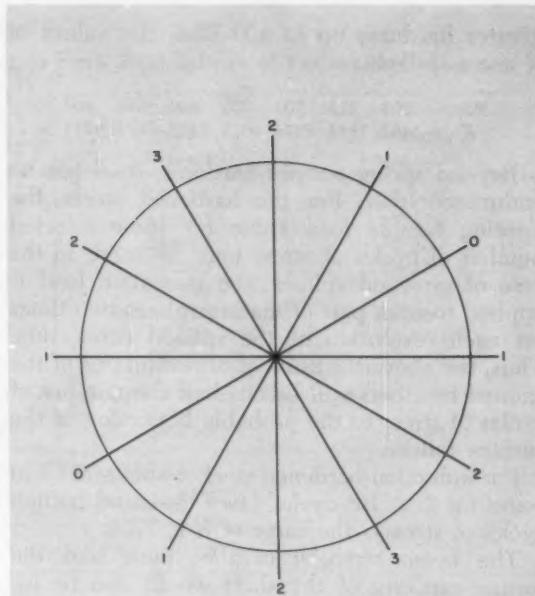


Fig. 5. Method of numbering tooth positions of a twelve-tooth crowned spline. Two teeth have maximum interference and are numbered 0. Teeth adjacent to the 0 position are marked 1, 2, and 3, the 3 position representing that of maximum clearance.

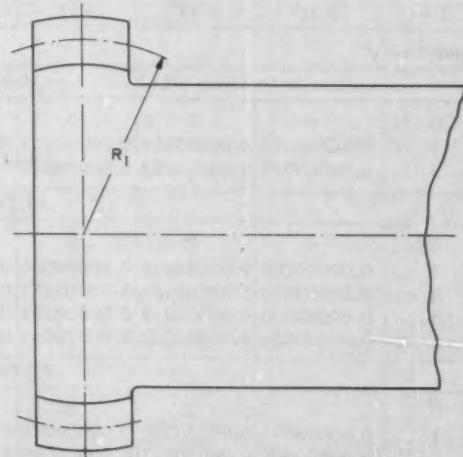


Fig. 6. For the examples in this article, the center of the radius of crowning for crowned splines is assumed to be on the axis of the shaft.

MACHINERY'S REFERENCE SECTION

greater hardness up to 400 Bhn, the values of K are as follows:

Bhn =	250	275	300	325	350	375	400
K =	1492	1844	2238	2673	3152	3674	4240

Beyond spring temper hardness, steel has no endurance limit. For the hardened steels, the limiting fatigue load value for some selected number of cycles of stress must be used. In the case of crowned splines, the maximum load is applied to each pair of mating splines two times for each revolution of the splined connection. Thus, the allowable number of revolutions of the splined members will be one-half the number of cycles of stress to the probable beginning of the surface failure.

For induction-hardened steel of about 500 Bhn—and for 2×10^9 cycles (two thousand million cycles of stress)—the value of K is 7758.

The beam strength of the spline and the torque capacity of the shaft would also be increased with an increase in the Bhn value of the steel. These increased values are shown in Table of 1/2 pitch, together with the values of K and the limiting wear load per inch of contact.

7 for the eight-tooth, 30-degree involute spline

Load and Elastic Deformation

The loads on crowned splines are applied substantially uniformly from crest to root of the splines, as in the case of straight splines. The elastic deformations will therefore be the same—about 0.001-inch deformation with a tooth load of 4000 pounds per inch of face of the tooth. With the 0.500-inch tooth face used for the 2-inch diameter splines, a spline load of 2000 pounds on these face widths will bend and compress the materials an amount equal to 0.001 inch. Table 8 gives the starting values needed to compute the total load capacities given in Table 9 for misaligned crowned splines. The lower part of Table 8 gives the limiting wear loads and deformations for steels of various hardness for splines of various pitches, all having 0.500-inch face width and 2-inch pitch diameter.

The total load calculations summarized in Table 9 are made in the same way as before. The driving teeth will carry the full limiting load, given in Table 8, which will develop the tabulated amount of deformation. For all other teeth, when the tabulated amount of deformation is larger than the clearance, those splines will carry

Table 6. Clearances on 8-, 16-, and 32-Tooth Crowned Involute Splines of 2-Inch Pitch Diameter.

$\Delta =$	0.05°	0.10°	0.15°	0.20°	0.25°	0.30°	0.50°	1.00°	2.00°
Tooth No.	Clearances, C ₁								
<i>8-Tooth Splines, 4/8 Pitch</i>									
0	0	0	0	0	0	0	0	0	0
1	0.00000019	0.00000126	0.00000171	0.00000304	0.00000476	0.00000904	0.00007615	0.00030041	
2	0.00000038	0.00000252	0.00000343	0.00000609	0.00000952	0.00001808	0.00015230	0.00060083	
<i>16-Tooth Splines, 8/16 Pitch</i>									
0	0	0	0	0	0	0	0	0	0
1	0.00000006	0.00000037	0.00000050	0.00000101	0.00000139	0.00000265	0.00002230	0.00008799	
2	0.00000019	0.00000126	0.00000171	0.00000304	0.00000476	0.00000904	0.00007615	0.00030041	
3	0.00000033	0.00000216	0.00000294	0.00000523	0.00000817	0.00001552	0.00013071	0.00051566	
4	0.00000038	0.00000252	0.00000343	0.00000609	0.00000952	0.00001808	0.00015230	0.00060083	
<i>32-Tooth Splines, 16/32 Pitch</i>									
0	0	0	0	0	0	0	0	0	0
1	0.00000001	0.00000010	0.00000013	0.00000023	0.00000036	0.00000069	0.00000580	0.00002287	
2	0.00000006	0.00000037	0.00000050	0.00000101	0.00000139	0.00000265	0.00002230	0.00008799	
3	0.00000012	0.00000078	0.00000104	0.00000188	0.00000294	0.00000558	0.00004701	0.00018545	
4	0.00000019	0.00000126	0.00000171	0.00000304	0.00000476	0.00000904	0.00007615	0.00030041	
5	0.00000026	0.00000176	0.00000239	0.00000424	0.00000663	0.00001260	0.00010613	0.00041868	
6	0.00000033	0.00000216	0.00000294	0.00000523	0.00000817	0.00001552	0.00013071	0.00051566	
7	0.00000037	0.00000242	0.00000330	0.00000586	0.00000916	0.00001739	0.00014650	0.00057796	
8	0.00000038	0.00000252	0.00000343	0.00000609	0.00000952	0.00001808	0.00015230	0.00060083	

Table 7. Limiting Load Values for Crowned 8-Tooth, $\frac{1}{2}$ Pitch Steel Splines of Various Hardnesses

BHN	K	Wear Load for 1-inch Contact Ww	Tooth Beam Strength	Torsional Strength, 2-inch Shaft
225	1,181	4,092	28,526	25,000
250	1,492	5,168	31,690	27,770
275	1,844	6,387	34,860	30,550
300	2,238	7,752	38,030	33,330
325	2,673	9,260	41,200	36,110
350	3,152	10,918	44,370	38,880
375	3,674	12,727	47,540	41,660
400	4,220	14,618	50,710	44,440
<i>Values for induction hardened steel based on a life of 2×10^6 cycles of stress</i>				
500	7,758	26,784	50,710	44,440

Increase of Capacity from 225 BHN to 325 BHN:

For tooth beam strength 44%
 For torsion 44%
 For surface endurance 126%

Table 8. Limiting Unit Loads and Deformation for Crowned Splines of 225 BHN.

No. of Teeth =	8	16	32
Lewis Factor =	0.713	0.817	0.892
Unit Tooth Load for $\frac{1}{2}$ P =	28,526	32,672	35,688
For 1" Face, 2" Dia. =	7,132	4,084	2,230
Deformation =	0.001784	0.001021	0.000557
<i>Crowned Splines: 2-Inch Diameter; 0.50-inch Face; 225 BHN Steel.</i>			
Tooth Strength =	3,566	2,042	1,115
Pitch =	4/8	8/16	16/32
<i>Limiting Wear Load Per Tooth and Deformation.</i>			
Bhn = 225 Load =	1,023	511	256
Def. =	0.00051150	0.00025550	0.00012800
Bhn = 250 Load =	1,292	646	323
Def. =	0.00064600	0.00032300	0.00016150
Bhn = 275 Load =	1,597	798	399
Def. =	0.00079850	0.00039900	0.00019950
Bhn = 300 Load =	1,938	969	484
Def. =	0.00096900	0.00048450	0.00024200
Bhn = 325 Load =	2,305	1,152	576
Def. =	0.00115250	0.00057600	0.00028800
Bhn = 350 Load =	2,729	1,365	682
Def. =	0.00136450	0.00068250	0.00034100
Bhn = 375 Load =	3,182	1,591	795
Def. =	0.00159100	0.00079550	0.00039750
Bhn = 400 Load =	3,654	1,827	914
Def. =	0.00182700	0.00091350	0.00045700
<i>Induction Hardened Steel for 2×10^6 Cycles of Stress.</i>			
Bhn = 500 Load =	6,696	3,348	1,674
Def. =	0.00334800	0.00167400	0.00083700

Table 9. Wear Loads on Misaligned Crowned Splines:**2-Inch Diameter; 225 BHN Steel.**

$\Delta =$	0°	0.05°	0.10°	0.15°	0.20°	0.25°	0.50°	1.00°	2.00°
<i>Spline</i>	<i>Maximum Loads For Wear</i>								
8-Tooth	8184	8181	8164	8156	8135	8108	8030	6975	3735
16-Tooth	8184	8177	8135	8116	8077	8015	7890	5786	2362
32-Tooth	8184	8171	8111	8082	7994	7887	7612	3573	1673

Table 10. Wear Loads on Misaligned Crowned Splines:**2-Inch Diameter; 325 BHN Steel.**

$\Delta =$	0°	0.05°	0.10°	0.15°	0.20°	0.25°	0.50°	1.00°	2.00°
<i>Spline</i>	<i>Maximum Loads For Wear</i>								
8-Tooth	18440	18437	18420	18412	18391	18366	18295	17222	13633
16-Tooth	18440	18433	18400	18385	18337	18279	18142	15990	8896
32-Tooth	18440	18428	18358	18322	18236	18127	17852	13547	5694

some smaller load. They will be deformed an amount equal to the tabulated deformation minus the clearance. The amount of load carried will be directly proportional to the amount of deformation. When the clearance is greater than the tabulated value of the deformation, those teeth will carry no load.

For straight splines, the area of the section of the deformation wedge in relation to the sectional area of the deformation lamina was used as a measure of the tooth load. For crowned splines, the amounts of the deformation of the several teeth in relation to the maximum deformation—and load—on the driving teeth will be used in the same manner.

For purposes of direct comparison, Table 9 gives computed values for the limiting wear loads on crowned splines of eight, sixteen, and thirty-two teeth, using the same 225 Bhn steel. The loads calculated for the tooth Nos. 0 and $N/4$ will be multiplied by 2, and those of all other tooth numbers will be multiplied by 4, and all of these weighted values will be added to obtain the total load on the splined connection. The values of the clearances are tabulated in Table 6.

Comparisons of Straight- and Crowned-Splined Connections

A careful comparison of Tables 4, 5, and 9 is worthwhile. All of these splined connections

are of 225 Bhn steel. The limiting torsional load at the pitch line in all cases is about 25,000 pounds. The limiting loads shown in Tables 4 and 5 for straight splines are the *beam strengths* of the teeth. Those in Table 9 for crowned splines are the *surface endurance limits* of the materials.

For further comparisons, Table 10 gives the surface endurance capacities for crowned splines of 325 Bhn. Table 11 gives these values for crowned splines of 400 Bhn steel.

Table 12 has been arranged for a ready comparison of eight- and sixteen-tooth splines of the three designs covered in this study—straight splines with 2-inch face, straight splines with 0.500-inch face, and crowned splines.

In all cases, if the 0.25-degree angle of misalignment is used, the crowned spline has the greatest capacity. If the maximum misalignment is restricted to 0.20 degree, the 0.500-inch face straight spline with eight teeth has the largest capacity; for sixteen teeth, the crowned splines have the greatest capacity. If the maximum misalignment angle is restricted to 0.10 degree, the eight-tooth and sixteen-tooth splines with 0.500-inch face have the greatest capacity.

All of these splines are of 2-inch pitch diameter. As the diameters and pitches of the splines change, the limiting loads will change also. When the number of splines is constant, the pitch will change directly as the change in the diameter. The limiting torsional load in pounds at the

pitch radius will change as the square of the radius or diameter. In terms of inch-pounds of torque, this limiting load will vary as the cube of the diameter. The limiting beam strength and the surface endurance limit load for the crowned teeth will vary directly as the diameter. The elastic deformation of the tooth will be the same for the same load and tooth form regardless of the pitch. The clearances will vary directly as the diameters.

Effect of Change in Hardness of Steel on Load Capacities

When the materials are changed to harder steels, the unit loads, together with the amount of deformation under increased loads, will be increased, while the extent of the clearances will remain unchanged. This will increase the limiting load capacity for any given spline and angle of misalignment somewhat more than the percentage increase in the limiting unit loads. The actual amount of these loads must be calculated. A comparison of the load values in Tables 9, 10, and 11 of the capacities of the same splines made

of different materials or hardnesses of steel will bring this out.

A comparison of the ratios of unit load values of steels of 225, 325, and 400 Bhn for the eight-tooth crowned splines shows the following. The same ratios will hold true on all other numbers of splines.

For perfect alignment ($\Delta = 0^\circ$):

$$\begin{aligned} 225/225 & \quad 8184/8184 = 1.000 \\ 325/225 & \quad 18440/8184 = 2.253 \\ 400/225 & \quad 29232/8184 = 3.571 \end{aligned}$$

For 0.25-degree misalignment:

$$\begin{aligned} 325/225 & \quad 18366/8108 = 2.265 \\ 400/225 & \quad 29156/8108 = 3.595 \end{aligned}$$

For 2-degree misalignment:

$$\begin{aligned} 325/225 & \quad 13633/3735 = 3.650 \\ 400/225 & \quad 24425/3735 = 6.539 \end{aligned}$$

From these comparisons it is seen that the combinations of the clearances and the increased elastic deformations give varying ratios for the several different combinations of hardness.

**Table 11. Wear Loads on Misaligned Crowned Splines:
2-Inch Diameter; 400 BHN Steel.**

$\Delta =$	0°	0.05°	0.10°	0.15°	0.20°	0.25°	0.50°	1.00°	2.00°
<i>Spline</i>									
8-Tooth	29232	29229	29212	29203	29183	29156	29087	28014	24425
16-Tooth	29232	29226	29188	29177	29132	29079	28942	26790	19576
32-Tooth	29232	29221	29165	29126	29047	28919	28668	24362	11985

**Table 12. Comparison of Limiting Loads on 8 and 16 Tooth Involute Splines:
2-Inch Diameter; 225 BHN Steel**

$\Delta =$	0°	0.05°	0.10°	0.15°	0.20°	0.25°	0.50°
<i>Table No.</i>							
	8-Tooth Splines.						
4	114,112	40,440	13,820	7,304	4,480	3,100	1,456
5	28,526	28,526	27,024	15,498	10,127	7,092	2,564
9	8,184	8,181	8,164	8,156	8,135	8,108	8,039
<i>Table No.</i>							
	16-Tooth Splines.						
4	130,688	19,250	6,700	3,560	2,360	1,720	544
5	32,672	32,670	13,574	7,306	5,048	3,424	1,184
9	8,184	8,177	8,135	8,116	8,077	8,015	7,890

Table 13. Comparison of Loads on 16-Tooth Splines of 2-Inch Pitch Diameter and 4-Inch Pitch Diameter; 225 BHN Steel

$X_1 = 4.00$ -Inch Pitch Dia.; 4/8 Pitch; 1.00-Inch Face; Straight Spline.
 $Y_1 = 2.00$ -Inch Pitch Dia.; 8/16 Pitch; 0.50-Inch Face; Straight Spline.

<i>Limiting Beam Loads - Straight Splines.</i>							
$\Delta =$	0°	0.05°	0.10°	0.15°	0.20°	0.25°	0.50°
$X_1 =$	130,688	130,552	57,368	30,224	19,316	13,228	4,624
$Y_1 =$	32,672	32,670	13,574	7,306	5,048	3,424	1,184
$X_1/Y_1 =$	4.000	4.000	4.226	4.136	3.826	3.863	3.905

$X_2 = 4.00$ -Inch Pitch Dia.; 4/8 Pitch; 1.00-Inch Face; Crowned Splines.
 $Y_2 = 2.00$ -Inch Pitch Dia.; 8/16 Pitch; 0.50-Inch Face; Crowned Splines.

<i>Limiting Wear Loads - Crowned Splines.</i>							
$\Delta =$	0°	0.05°	0.10°	0.15°	0.20°	0.25°	0.50°
$X_2 =$	32,736	32,691	32,623	32,594	32,507	32,399	32,124
$Y_2 =$	8,184	8,177	8,135	8,116	8,077	8,015	7,890
$X_2/Y_2 =$	4.000	4.003	4.010	4.016	4.024	4.042	4.106

Influence of Diameters of Splines

As a final comparison, the limiting load conditions for sixteen-tooth straight splines of 4-inch pitch diameter, 4/8 pitch, and 1-inch length of engagement will be compared with the sixteen-tooth spline of 2-inch pitch diameter, 8/16 pitch, and 0.500-inch length of engagement. These two splines are geometrically alike. A similar comparison will be made for the limiting loads on

these same splines when they are crowned. These comparisons are shown in Table 13.

By dimensional analysis, the load capacities with the same materials and geometrically similar splines should vary with the square of the diameters. In this example, the capacities of the splines of double diameters should be four times those of the smaller splines. The differences in the ratios shown in Table 13 are probably the result of rounding off decimals in the calculations.



A lightweight, two-stage portable dimpling tool that operates in areas formerly inaccessible to ram-coined dimpling equipment has been developed by the Boeing Aero-Space Division in Seattle, Wash. It is hydraulically operated, weighs only 6 pounds, and can be operated with heated dies. Instead of having a conventional C-yoke, the dimpler utilizes a high-strength tool-steel mandrel that will withstand forming pressures of several tons. Dual action of the hydraulic unit produces a clamping force in one direction and a forming force in the opposite direction.

102 Engineering Students Win Machine Design Awards

The following 1961 graduates have been named by their respective engineering colleges as the recipients of MACHINERY's Achievement Award for outstanding excellence in machine design. The award, a copy of MACHINERY'S HANDBOOK and its companion volume, "The Use of Hand-

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Ball-Bearing Brinell

Instruction in proper mounting of bearings to prevent damage and premature failure under operating conditions is one of the vital subjects covered in a series of traveling maintenance seminars conducted by the Fafnir Bearing Co., New Britain, Conn. A predominant cause of early ball-bearing failure is the Brinelling, or denting, which sometimes appears high on the shoulder of the race and correspondingly on each ball. This happens most often when extra force is applied against the unmounted ring while mounting a bearing on a shaft with a fit. Pushing of the outer ring exerts an excessive thrust load, bringing the balls into sharp contact with the race shoulder. The result is a dent, or Brinell mark.

Radial indentations may also be imposed on a nonrotating bearing by hitting it with a hammer or by exerting an operating shock load on a static shaft. This type of Brinell is less common than that caused by mounting practices because the rings are likely to fracture under the sharp impact of radial shock load.

In mounting a bearing, the company advises, force should always be exerted against the raceway being mounted: i.e., the inner raceway when mounting on a shaft; the outer ring when mounting in a housing. In other words, the ring having the tighter fit (usually the raceway which will rotate in application) should be pressed. Installers should apply pressure slowly and evenly.

Largest Vertical Dynapak Now In Pilot Phase

EVALUATION of high-energy-rate forming as a production tool is pushing forward rapidly at the Research Center of American Brake Shoe Co., Mahwah, N. J., where General Dynamics' Model 1810 Dynapak machine is in pilot production. Utilizing a ram velocity ranging from 250 to 1500 ips, this machine (Fig. 1) is doing operations such as forging, extruding, compacting, and blanking. In addition to conventional forming of carbon, high-speed and stainless steels, copper, and aluminum alloys, the high-energy-rate principle has proved capable of handling alloys that had previously been difficult or impossible to form. The latter include high-temperature and exotic metals such as commercially pure tungsten, molybdenum, titanium, columbium, and zirconium. Maximum die size is 22.5 inches in diameter. Tools are usually circular.

A simplified explanation of the principles by which this machine is able to accomplish such work is based on its high ram speed. So fast and so powerfully does the ram propel the tool into the work that the work metal is "surprised." The metal is so surprised that it "forgets" those characteristics that cause it to resist movement within a die cavity. Thus overpowered, the work metal is accurately and rapidly formed. In the lower right corner of Fig. 2 is a 9.10-pound billet of alloyed, sintered copper which is formed by one blow into the steel-mill oxygen-lance nozzle appearing just below the scale. Above the scale is the punch, and on the left is the die used in the Dynapak. Obviously this forming method conserves a great deal of copper, as compared to the slug needed to form the nozzle "from the solid."

The Dynapak's operation is based on the principle of pneumatics used in an air rifle. In one chamber, gaseous nitrogen is stored at a pressure (that may vary with the job) up to 2000 psi. When the Dynapak machine is in "cocked" position, low-pressure gas (nitrogen) at about 200 psi holds the ram piston against an orifice plate. A seal in the piston face isolates all of the piston's surface from the high-pressure nitrogen except for a small area surrounded by the seal. With high-pressure gas acting on the small area, and the low-pressure gas holding against the larger area, a balanced condition exists.

When the machine is triggered, the equilibrium condition is upset by slight additional pressure on the high-pressure side of the piston. As the



Fig. 1. Research technician at American Brake Shoe Laboratory, using tongs, loads heated slug from the furnace on the left into the dies of the Dynapak while a colleague stands ready to trigger the ram.

latter begins to move, the seal is disengaged, exposing the entire face of the ram piston to the high-pressure gas. Thus, greatly overbalancing the low-pressure gas in the opposing chamber, the now-released high-pressure nitrogen ram and punch stab into the work at velocities as high as 2000 psi. This speed depends upon the size of the piston, the pressures used in the two chambers, and the weight of the ram.

After the machine has been fired it is cocked again by a hydraulic pump which recompresses the nitrogen in the high-pressure chamber. Cycle time with the Dynapak 1810 is 105 seconds, floor-to-floor.

Fig. 2. High-energy-rate forming dies have to be specially reinforced to withstand the formidable pressures used to form the copper oxygen-lance nozzle blank (lower center) from the billet (lower right) in one shot.



Broaching Machine Departs from Conventional Design

TO ARRIVE at what is thought to be the ideal condition in pull-up broaching, a newly designed machine makes use of high-efficiency ball-bearing screws (in matched pairs) driven through a gear-box. Power is transmitted directly from the gear-box, through the screws, and to the broach—the machine ways and slide only serving to guide and stabilize the tool.

This arrangement eliminates the bending force and losses in the slide ways caused by the cantilever-beam effect of the former method of driving the slide which, in turn, drives the broach. A unique following attachment gives added stability to the tool by grinding it throughout the 72-inch cutting stroke.

Built by the Lapointe Machine Tool Co., Hudson, Mass., this Model VUE-4 vertical pull-up machine is powered by a 30 hp electromechanical drive which—when coupled with the matched ball screws—is said to account for a pulsation-free movement and an unusually smooth cutting action, resulting in improved surface finish. As an outgrowth, one manufacturer plans to eliminate a final shaving operation in the production

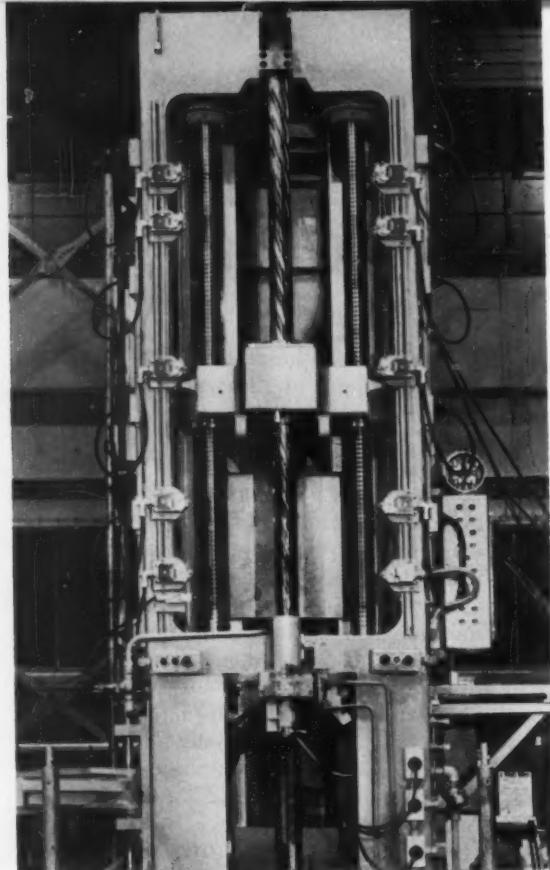


Fig. 1. Chatter is eliminated by departing from conventional design of pull-up broaching machine. Here, a pair of matched ball-screws provide a direct, in-line pull to the cutting tool.

of accurate gears. Another claimed advantage is approximately a 50 per cent improvement in tool life due to chatter elimination.

The illustrated machine is a special one developed for broaching automotive pump gears for automatic transmissions. These gears have twenty-nine helical involute splines broached from a 2.913 inch diameter hole. Blanks are broached two at a time in a one-minute cycle (120 per hour) at 80 per cent efficiency using a speed of 20 fpm.

Push-button controls provide manual, semi-automatic, or fully automatic operation. An independent auxiliary hydraulic system operates the fixture and broach-lifter mechanism. This machine is built to operate at infinitely variable speeds ranging from 5 to 40 fpm. It also offers a dual-speed feature that permits the broach speed to be changed automatically at any pre-determined point in the stroke.

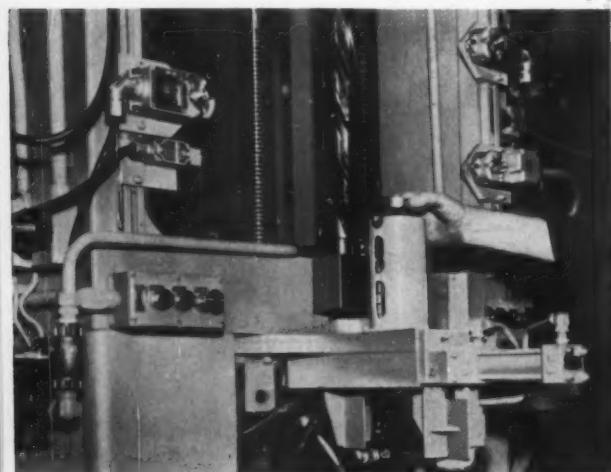
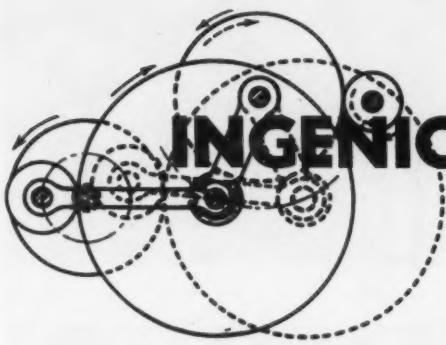


Fig. 2. Vertical tubular magazine holding about twenty-four parts can be seen in this close-up of gear-loading mechanism. A spiral lead bar attachment (immediately in front of magazine) drives the helical spline broach.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Adjustable Eccentric

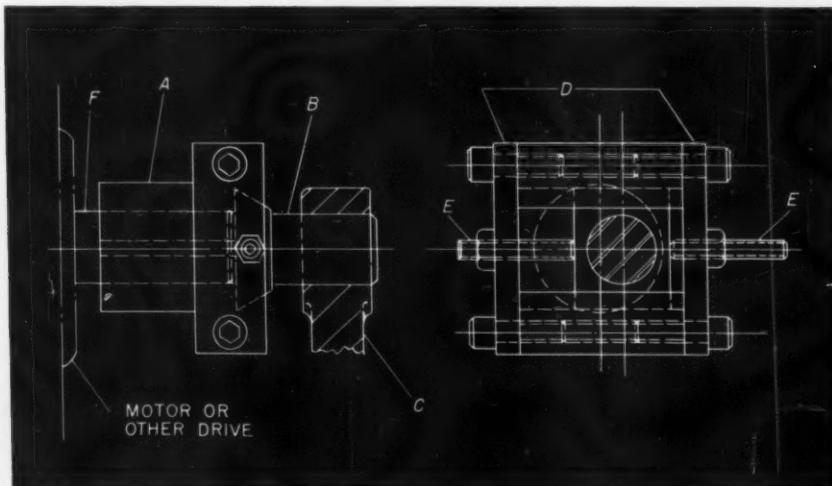
ROGER ISETTS, Kenosha, Wis.

In the design of various types of machines, an eccentric motion is often needed to operate certain mechanisms. A relatively simple arrangement for obtaining such eccentric movement from a rotary drive is here shown. The resultant drive is positive and can be adjusted quickly and easily, thus avoiding time-consuming dismantling and reassembly.

In construction, adapter *A*, made from a rectangular piece of cold-rolled steel, is turned on one end. In addition, a hole is bored through the part and a keyway is provided to fit the driving shaft. A female dovetail is milled in the rectangular section at the opposite end. From a square piece of cold-rolled steel, a male dove-

tail slide *B* is then machined to fit the adapter. One end of this member is turned to fit a connecting-link arm *C*. Two side-plates *D*, made from flat stock, are bolted to the sides of the adapter with socket-head cap-screws, as shown. Each plate also has a hole tapped to receive headless set-screws *E*, which are used for adjusting the amount of eccentricity and for locking the slide *B* securely in place during operation of the connected drive.

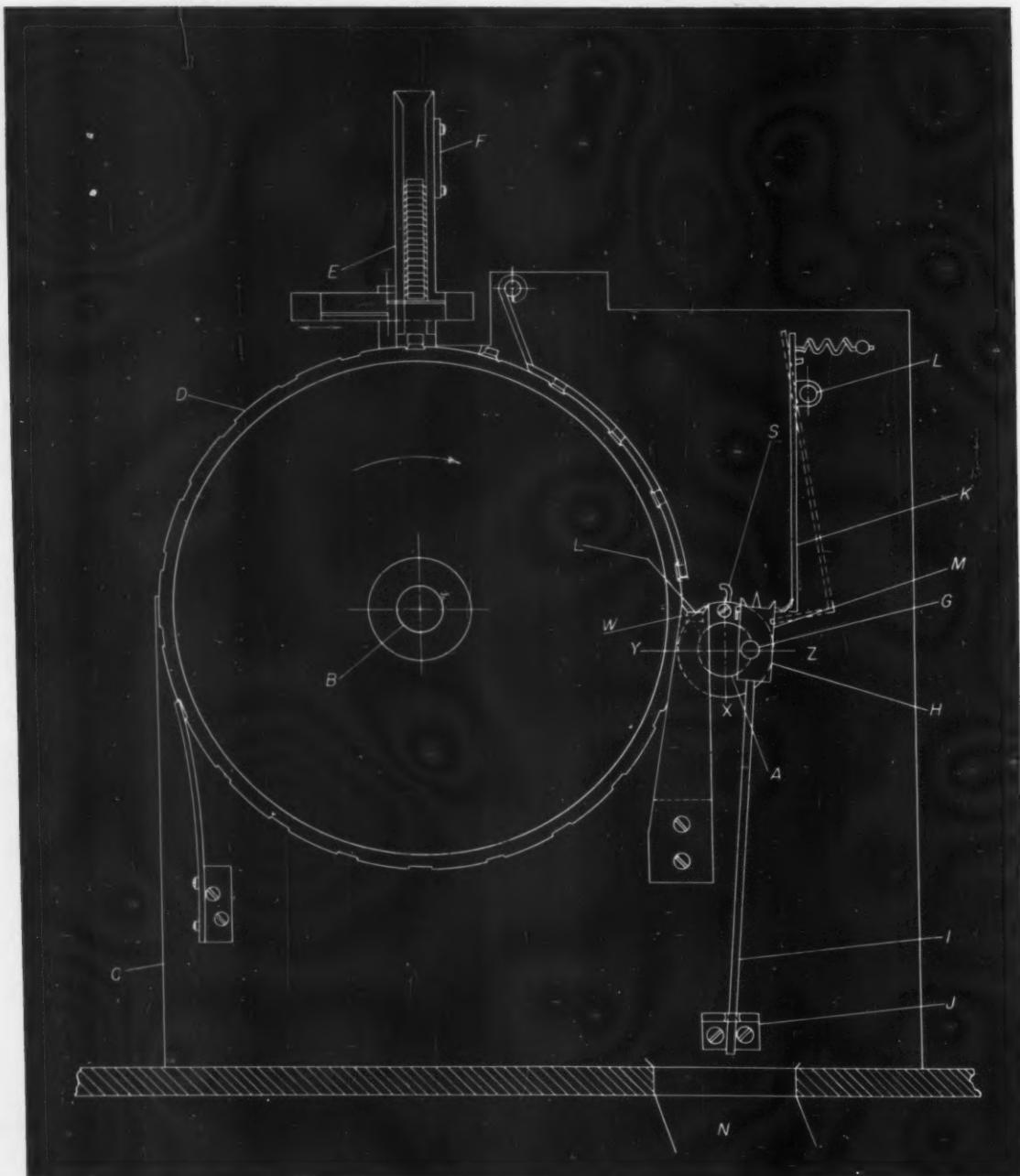
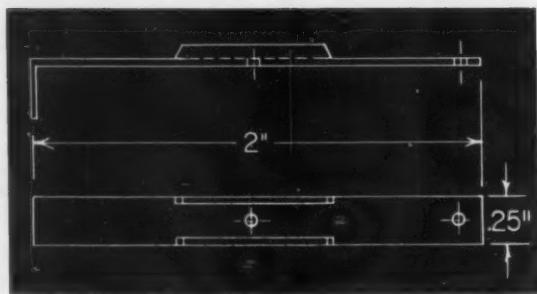
The slide and adapter may be scribed with gage lines, if desired, in case minute adjustment is needed. Of course, a straight drive can be obtained simply by aligning the slide with the center of the drive-shaft *F*.



Simply constructed adjustable eccentric

Fig. 1. (Right) Work-piece is a formed brass spring. The rivet hole is on the right, and the guide hole in the center.

Fig. 2. (Below) Positioning and assembly drum indexes by ratchet from shaft (A). The riveting anvil is contacted with the pick-off (H) in (Z) position, as shown, but is not included in this diagram.



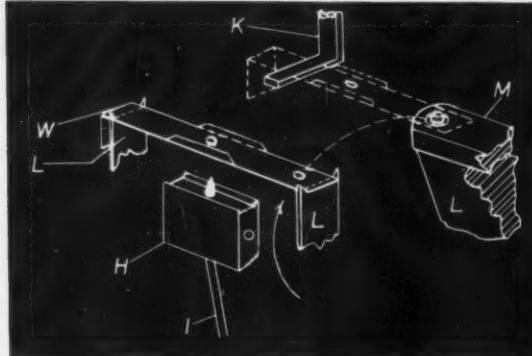


Fig. 3. Lift, carry, and mating steps in the operation of the machine are automatic, with the pick-off (H) rising between the prongs of dwell cradle (L).

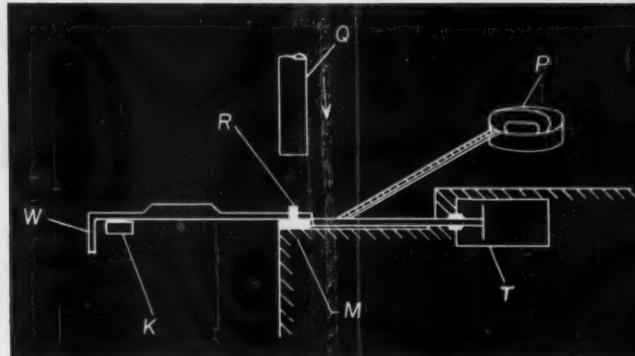


Fig. 4. Marriage of spring (W) with hole finding the rivet (R) on anvil (M). Air cylinder (T) delivers rivet from track of vibratory hopper (P). Hammer (Q) upsets rivet shank.

Assembly Operation Mechanized

GEORGE G. SIPOSS, Toronto, Canada

A rivet is used as an electrical contact on the end of a formed sheet-brass spring, Fig. 1, made in volume. Until recently the contact rivets were manually assembled into the hole in the spring blade and headed under an air hammer. The manual operation was slow and tedious for the operators because of the 0.001-inch clearance of the rivet in the hole.

More recently the assembly has been made semiautomatic, with the operator's duties now restricted to stacking the properly oriented spring blades in a magazine slide and occasionally dumping a boxful of rivets into a Syntron vibratory hopper feeder. The successful assembly mechanism was comparatively simple to build.

The spring blades are automatically placed over the rivet shanks by a pick-off transfer from a Ferris wheel drum, Fig. 2. The main drive is shaft A, which rotates constantly at 100 rpm in a bearing through backing plate C. Keyed to shaft A, but behind plate C, is a cam which, through a lever and pawl linkage, drives a ratchet wheel turning shaft B. The rotation of drum D is thus intermittent, and each of its twenty-two stop indexes per rotation is aligned with the springs that drop one at a time from magazine F. The springs lie in the carrier grooves with the bent tab (Fig. 1) pointing upward.

As the drum indexes, the work is held in place by a retaining strap, or guide, that wraps around the outside of the drum. The strap ends at a position that would correspond on a clock to quarter to three. Here, the spring rolls out of the groove, landing horizontal, with the tab pointing down, on the two arms of a dwell cradle L that straddles the drum at this point, Fig. 3.

The spring, as it rests in the dwell cradle, is

now positioned for transfer and placement over the shank of the rivet that will be waiting on the anvil M, as in Fig. 4. Transfer is accomplished by a pick-off H, Figs. 2 and 3. The pick-off is a block that hangs on crankpin G, stud-mounted on the end of shaft A. The crankpin rotates once for each index of feed-drum D, carrying the pick-off with it. Stabilizer bar I in the bottom of the pick-off block holds it upright by virtue of a loose fit through a hole in bracket J.

The top of pick-off block H has a groove the width of the spring, and having sloping sides to facilitate seating of the part by gravity. Near the center of the groove is a pointed stud that "finds" the guide hole in the spring waiting in the dwell cradle.

As the crankpin carrying the pick-off travels upward from position X, Fig. 2, the spring is lifted from the dwell cradle at Y, with the stud through the guide hole and resting in the groove of the pick-off, Fig. 3. As the crank continues to turn, the spring is carried over to riveting position Z, Fig. 2, where the pick-off falls away, leaving the spring with the rivet assembled through the spring's rivet hole and supported by the anvil. The opposite end of the spring sits on rest lever K, Fig. 3.

A rivet, meantime, has been positioned by the arrangement in Fig. 3, which also shows the riveting setup. In Fig. 4, rivet R from hopper P is pushed by air cylinder T into position on anvil M. Air hammer Q upsets a head on the rivet. The hammer is actuated by a micro switch from a cam on shaft A, Fig. 2.

As soon as the rivet has been headed, a knock-off finger S on shaft A swings past, knocking support K out from under the work so that it drops into the discharge chute N, Fig. 2.

Machine Replaced—Production Increased 100 Per Cent

EARL PAUL, Plant Manager
Smith-Victor Corporation
Griffith, Ind.

REPLACEMENT of machines is often motivated by new designs and accessories that provide improved production at less cost. An example of this occurred recently at the Smith-Victor Corporation, Griffith, Ind., a leading manufacturer of photographic lighting equipment. For nearly a decade the ends of telescoping tubes used for height adjustment of light stands had been chamfered and faced on a tube-end finishing machine made by Pines Engineering Co., Inc., Aurora, Ill. Appraisal of an improved model (heading illustration) introduced by the same manufacturer led to replacement of the old equipment. As a result of heavier machine construction and a more positive way of holding alignment between the work and the cutter-head, greater accuracy and longer tool life are now obtained.

With the former equipment, it was necessary for the operator to manually pull a lever which closed the chuck jaws and fed the cutter-head to the work. The new machine is pneumatically operated, the chuck and spindle being actuated by foot-switch control. This frees both hands of the operator for stock handling and reduces operator fatigue.

Aluminum tubing ranging from 3/8- to 1-inch outside diameter and in 28-inch lengths is used in the company's line of light stands. Both ends of these tubes are chamfered on the inside and outside, and faced. After this end-finishing operation, the larger tubes are threaded on one end to mount into a leg yoke. All of the tubes are expanded on one end to accommodate a nylon ring which provides friction on the mating tube. The various-size tubes telescope, forming a unit which permits vertical adjustment and instant setting of the light stands.

Tubes are processed in runs of 5000 or more, with an average of 12,000 tube ends being finished in an eight-hour day, or a net rate of 1500 ends an hour. This represents a 100 per cent increase in production, since only 750 ends were finished an hour on the old machine.

The replacement has not only brought about a substantial reduction in production costs, but has also extended the life of the cutting tools. Now



Only two seconds are required for finishing each tube end in this setup. Foot-switch operation frees both hands for manipulation of the work-piece.

over 60,000 tubes (120,000 ends) are finished before the tools require resharpening. This is attributed to the even, positive pressures provided by the automatic feed. In addition, concentricity between the tools and the work, necessary to produce an accurate chamfer, is easily maintained. A complete change-over in setup for different tube sizes can be accomplished in less than three minutes.

TOOL ENGINEERING

Ideas

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Die Forms Hairpin Shape in Channel Section

L. KASPER, Philadelphia, Pa.

A bending die incorporating a pair of pivoting shoes produces a hairpin-like loop in the middle of a channel shape. The appearance of the part before and after bending can be seen in Fig. 1.

Common practice would be to form the hairpin

prior to forming the legs of the channel. But in this instance, the channel shapes without the hairpin are used in large quantities, while those with the hairpin are used in lesser quantities which do not warrant completely separate pro-

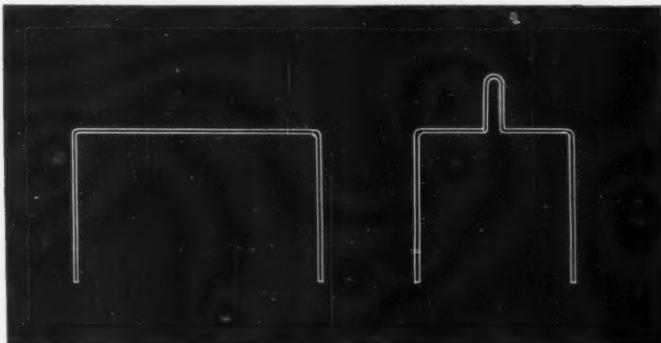
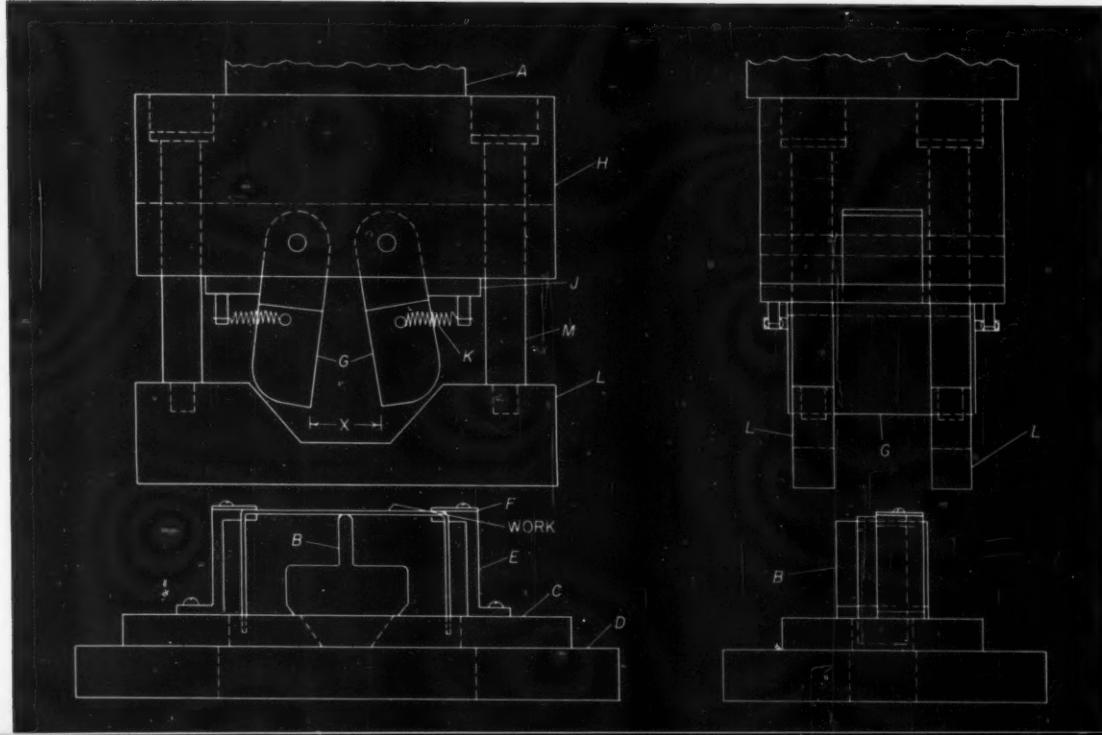


Fig. 1. The channel before (left) and after bending of the hairpin. Leg length remains the same; material for the hairpin is obtained by reducing the channel width.

Fig. 2. A channel has been loaded over forming block B, and with ram A ready to cycle, cam-plates L are still out of contact with the lower die section.



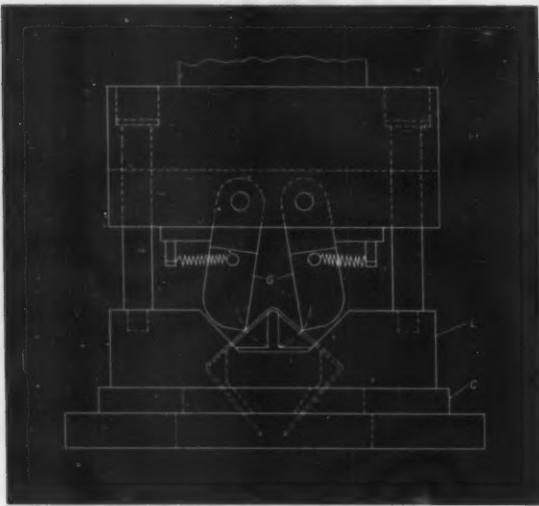


Fig. 3. At this point in the down stroke, cam-plates *L* bear on base *C*, and shoes *G* are ready to start the two reverse bends to form the hairpin.

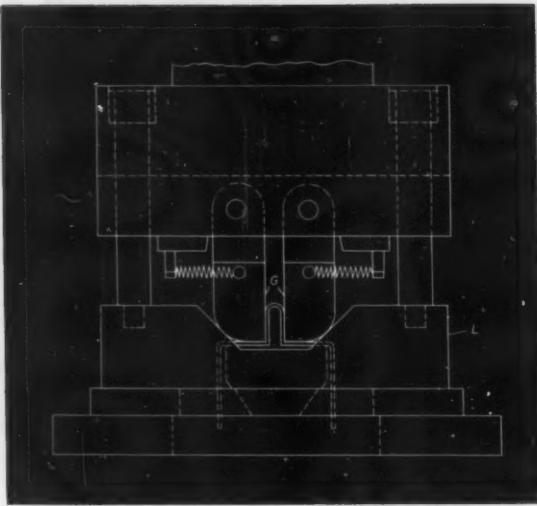


Fig. 4. End of the down stroke. Shoes *G* have been forced down the angular surfaces of cam-plates *L* and the hairpin is completed.

duction. Since the channels are made of a strip material that has been electroplated for corrosion resistance, it is important to avoid scuffing the surface. Stretching and thinning the material must also be avoided.

The die, illustrated in Figs. 2, 3, and 4, produces the required form by bending, rather than by drawing. Fig. 2 shows the die with the press ram *A* up. Forming block *B* is mounted on base *C*, which in turn is mounted on bolster *D*. Brackets *E* and plates *F* locate the work for forming.

The legs of the work are first inserted in clearance holes in the base and pushed against extensions which are at the back of the brackets and under the plates. The center of the work is supported by the top of the forming block, so that there will be a slight springing action to prevent rocking.

Both shoes *G*, in the upper part of the die, are free to pivot on member *H* which is mounted on the press ram. Next to each shoe is a backstop *J*,

to which the shoe is held by spring *K*. With the ram up, distance *X* is such that the shoes will strike the work at the two points which will form the corners of the hairpin.

Straddling the work is a pair of cam-plates *L* carried by stripper bolts *M* slidably mounted in member *H*. In Fig. 3, the ram is descending, and the shoes are bending the work around the forming block. The cam-plates now bear on the base. Further downward movement of the ram bends the work in a reverse direction at the points of contact with the shoes.

As the radii on the back of the shoes ride down the angular surfaces of the cam-plates, the shoes are forced toward center, following the arcs indicated by the broken lines. At the end of the down stroke, the work is completely formed, as shown in Fig. 4. Distance *X* (Fig. 2) and the angles of the cam-plate are predetermined to produce a bending action without any sliding or drawing of the work.

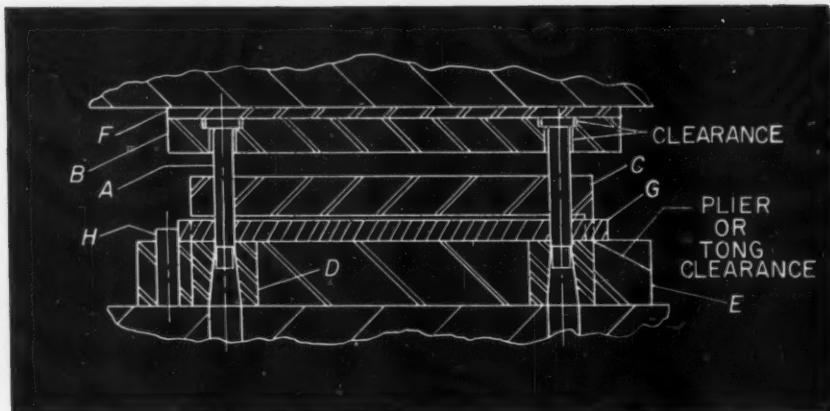
Economical Die for Piercing Holes Smaller than Stock Thickness

M. W. LOFTUS, Chicago, Ill.

The piercing of holes that are smaller in diameter than the thickness of the stock can be troublesome unless the die is properly built. However, when a limited number of parts are required, the die cannot be too elaborate or any saving in cost over that of drilling may be greatly reduced or eliminated. The die shown in the accompanying illustration proved both reasonable in cost and satisfactory in operation for piercing two 5/16-

inch diameter holes in 3/8-inch material for a production run of only 100,000 parts.

Two important considerations in designing dies for a job of this type are: (1) the punches must be accurately centered in the die openings and (2) the punches must be firmly supported as close to the working end as possible. In order to center the punches *A* accurately, the upper end of each was made to float in the punch-plate



Easily constructed die for piercing holes that are smaller in diameter than the stock thickness.

B and the lower end, a slip fit in the hardened and ground stripper *C*. The die buttons *D* were pressed in the die-block *E* rather than being made a slip fit, as is the general practice when using commercial buttons.

With the construction shown, it was easy to align the stripper openings with those in the die. Since the punches float, they are thus free to

move up and down with no binding in the stripper. A hardened piece of flat ground stock *F* backs the punches.

In piercing, the part *G* is placed in a slot in the stripper and is positioned endwise by a pin *H* in the die-block. The work-piece is handled with pliers or tongs, the clearance for which is provided at the end of the die-block.

Gage for Setting Cross-Slide Tools

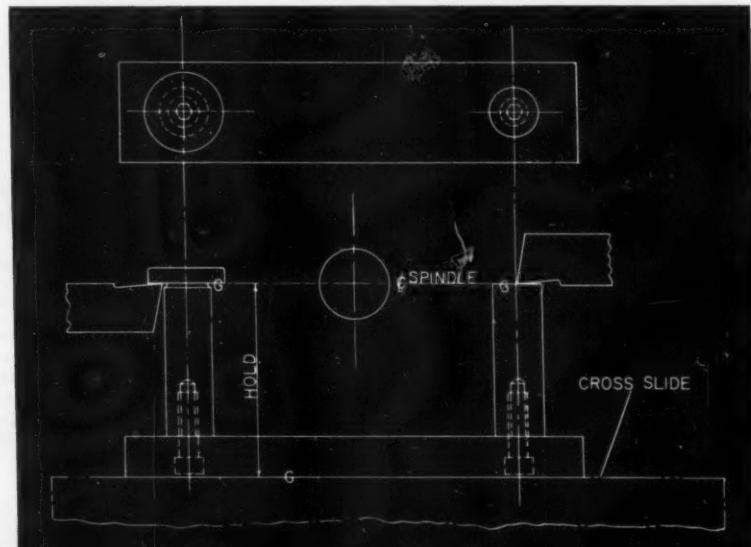
ROGER ISETTS, Kenosha, Wis.

In using cutting tools at both the front and rear of a lathe cross-slide, it is important to make certain that the cutters are exactly in line with the center of work if maximum efficiency is to be obtained. Illustrated is a simply constructed gage that will greatly speed the setting of such tools and eliminate time-consuming trial-and-error methods.

Two round hardened plugs are secured to a

base by means of socket-head cap-screws. The plug for the front cutting tool is made with a shoulder at the top end. The distance from the bottom surface of the head on this plug to the bottom of the base is made identical to the dimension from the center line of the spindle to the top of the cross-slide. Tools at the rear of a cross-slide must be used upside down, and so the other plug can be made without a shoulder.

Simple gaging device for checking the height of front and rear cross-slide tools.



Paul B. Schubert

NEW MATERIALS



The properties and new applications of materials used in the mechanical industries

Nickel-Alloy Steel that Withstands Extreme Stresses and Pressures

An 18 per cent nickel-alloy steel with unmatched toughness at the highest strength levels of traditional alloy steels has been developed by the International Nickel Co., Inc., New York City. Known as Mar-aged steel, it has the ability to achieve a yield strength in excess of 250,000 psi and has a notched tensile strength which exceeds 400,000 psi (measured under test conditions with a notch radius of 0.0005 inch). The alloy possesses a resistance to delayed cracking when exposed to severe corrosive atmosphere in a highly stressed condition. It develops its high strength while maintaining its ductility and toughness by means of a remarkably easy heat-treatment involving age-hardening of martensite. This treatment has been given the abbreviated description of "mar-aging."

The steel has a nominal composition of 18 per cent nickel, 7 per cent cobalt, 5 per cent molybdenum, and less than 0.5 per cent titanium with a maximum of 0.05 per cent carbon. Its unusually low work-hardening tendencies permit extensive cold-forming. The machining characteristics of the steel are good both as rolled and even as fully hardened. It can be readily welded either manually or automatically. Sound, crack-free welds are achieved even on material in the fully heat-treated condition without preheating. Postweld mar-aging restores the softened heat-affected zone of the parent plate to full strength and establishes in the weld metal properties closely approaching those of the baseplate.

Circle 565 on Readers' Service Card

Carbon Electrode Material for Electrical-Discharge Machining

A carbon electrode material for use in electrical-discharge machining, called Gentrode 10, has been made available by the General Electric Co., Schenectady, N. Y. It is said that the material machines steel three times faster than brass electrodes and provides the same smooth finish.

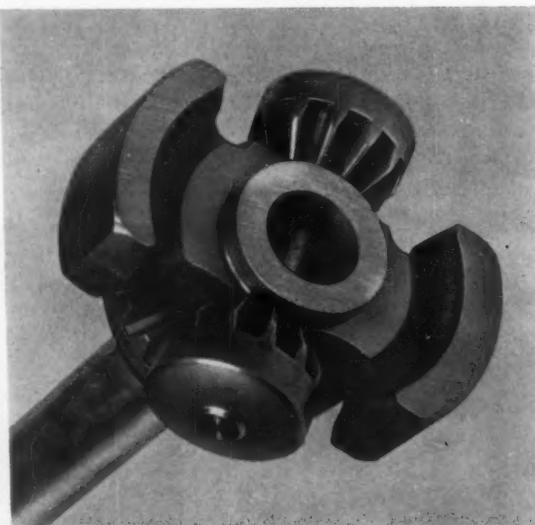
It is also said that it is not used up as fast as conventional brass electrodes, which makes possible use of shorter electrodes.

The carbon material is supplied in slab form, a typical slab of which measures 1 1/2 by 5 by 11 1/2 inches. It may be machined to any desirable electrode shape, without flaking or chipping, with greater ease than leaded brass.

Circle 566 on Readers' Service Card

Ceramic-Fiber Paper Provides Protection During Brazing Operations

A ceramic-fiber paper called Fiberfrax, which may be placed on a conveyor belt or fixture under the parts being brazed, has been announced by Carborundum Company, Refractories Division, Perth Amboy, N. J. The paper, which may also be used as a protective wrap for the parts, prevents deterioration of conveyor belts or fix-



These differential gears are made from easily machinable copper-infiltrated iron "Ollite (IM)," a product of Amplex Division, Chrysler Corporation, Detroit, Mich. The strength and wear characteristics are comparable to the 1045 steel formerly used for this application.
Circle 567 on Readers' Service Card

tures and product contamination. It is an alumina-silica fiber material that is lightweight yet physically strong. It is capable of continuous use at temperatures up to 2300 degrees F., and for short-cycle runs at higher temperatures. Other uses include heat-treating and vacuum brazing of metals such as titanium, zirconium, tantalum, and their alloys.

Circle 568 on Readers' Service Card

Nylon-Leather Power Transmission Belting for Conveyor Applications

A power transmission belting which has elasticity, is lightweight, and can be operated at 10,000 fpm has been announced by the Page Belting Co., Concord, N. H. Called Page-Lon, it is adaptable for paper-mill cone drives, short center drives with high pulley ratios, crossed and quarter turn drives, as well as conventional flat belting drives.

Circle 569 on Readers' Service Card

Product that Prevents Tarnishing of Copper in Moist Atmospheres

MacDermid Inc., Waterbury, Conn., has announced the availability of a liquid which can be added to the final water rinses after metal-finishing



These molybdenum-disulphide-filled nylon thrust washers (foreground and center) are being used in Sondzimir mill roll-backing assemblies at Wallingford Steel Co., Wallingford, Conn., for their wear- and abrasion-resistant properties. The washers are made from filled nylon called Nylatron GS, made by Polymer Corporation, Reading, Pa.

Circle 570 on Readers' Service Card

operations to provide temporary protection against tarnish in copper and brass. Metex Anti-tarnish M-667, as it is called, prevents tarnishing in moist atmospheres even when hydrogen sulphide is present. The product contains no chromates, oils, or waxes.

Circle 571 on Readers' Service Card

Brazing Alloys—Powders in High-Viscosity Vehicles

Brazing alloys in the form of powders in high-viscosity vehicles have been announced by Wall Colmonoy Corporation, Detroit, Mich. Designated Nicrobraz S series, the alloys are applied quickly and easily by a unique air-gun method for production work or by manual syringe for smaller jobs. It is said that alloying time is reduced 50 per cent with this alloy form.

Circle 572 on Readers' Service Card

Stripping Agent for Removing Nickel from Steel and Copper

An alkaline, cyanide-free stripper for removing nickel from steel, copper, brass, and other copper alloys, and from combinations of these basic metals, has been offered by Enthone, Inc., New Haven, Conn. Enstrip NP, as it is called, dissolves nickel by simple immersion at room temperature; elevated temperatures may be used for faster stripping. It is a stable solution which does not decompose when left idle for long periods of time.

The product is furnished as two liquid concentrates, Enstrip NP-1 and Enstrip NP-2, which are mixed together with water to make up the stripping solution. The solution may be contained in a plain steel tank or drum. At 175 degrees F., it will remove nickel plate at a rate of 0.003 inch per hour. The solutions are nonfuming.

Circle 573 on Readers' Service Card

Worm-Gear Lubricants with Wetability and Extreme-Pressure Characteristics

Two grades of worm-gear lubricants, called Conedroil A and Conedroil B, that provide exceptional wetability and extreme-pressure characteristics have been made available by Shear-Speed Chemical Products, Detroit, Mich. The use of these premium-quality lubricants causes an increase of efficiency and provides a long life for worm-gear sets. The "A" formulation exceeds AGMA No. 8 and 8A requirements. The "B" formulation provides lubrication exceeding AGMA No. 7 requirements.

Circle 574 on Readers' Service Card

NEW DEVELOPMENTS IN

Machine tools, unit mechanisms, machine parts, and

Chambersburg Announces Equipment for Automatic Production of forgings

Chambersburg Engineering Co., Chambersburg, Pa., has announced the introduction of a fully automatic process and equipment for the production of a wide variety of drop forgings in jobbing-lot quantities. The equipment for applying this process, known as the Cecomatic, consists of three new units, a Model "C" Impacter, a unique program-controlled feed device, and an automatic gas-fired furnace, as shown in Fig. 1. Three sizes are being offered initially to accommodate

a complete range of drop forgings usually made in gravity drop-hammers having capacities from 1000- to 3000-pound falling weight or in comparable sizes of forging presses. Larger installations are feasible and will be engineered as the demand for them develops.

The Cecomatic process is said to be capable of making forgings at exceptional production rates, yet retains a flexibility of operation which makes it possible to quickly change jobs. Thus short runs or jobbing-lot quantities of

work can be economically scheduled. The first installation of this new process, Fig. 1, is in successful operation at the Clauss Cutlery Co.'s factory in Fremont, Ohio. Shown at the right in this installation is an automatic gas-fired furnace; at the center is a Model C Impacter and program-controlled feed device; and at the left rear, a comprehensive control panel with selectors and electric controls for programming the forging operation. Fig. 3 shows one of the scissors forgings pro-

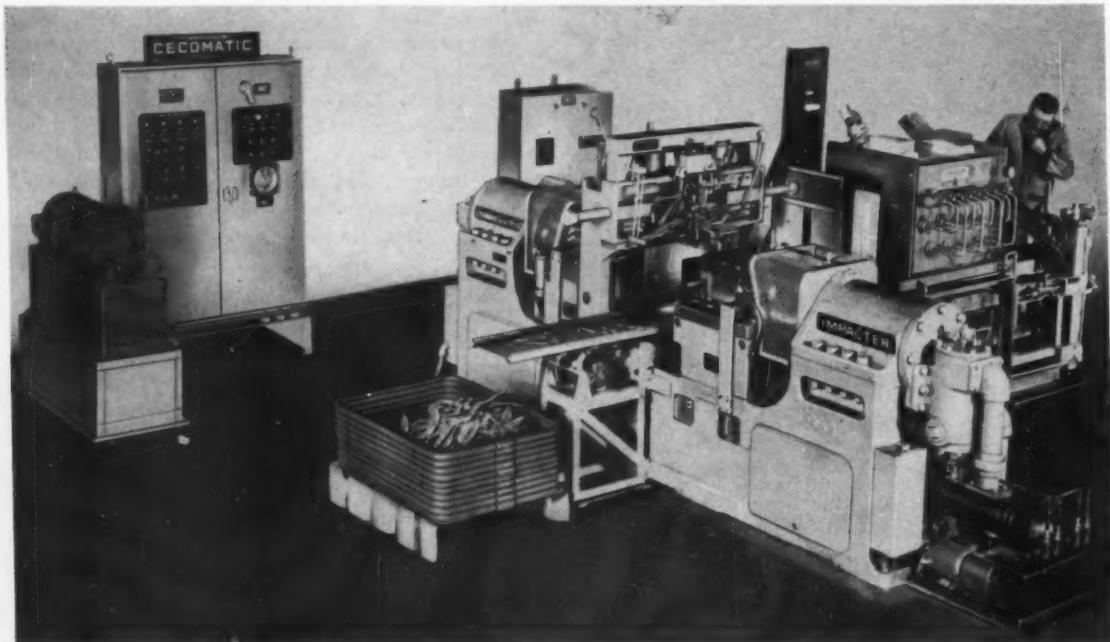


Fig. 1. Fully automatic Cecomatic process unit for producing jobbing-lot forgings

SHOP EQUIPMENT

material-handling appliances recently introduced

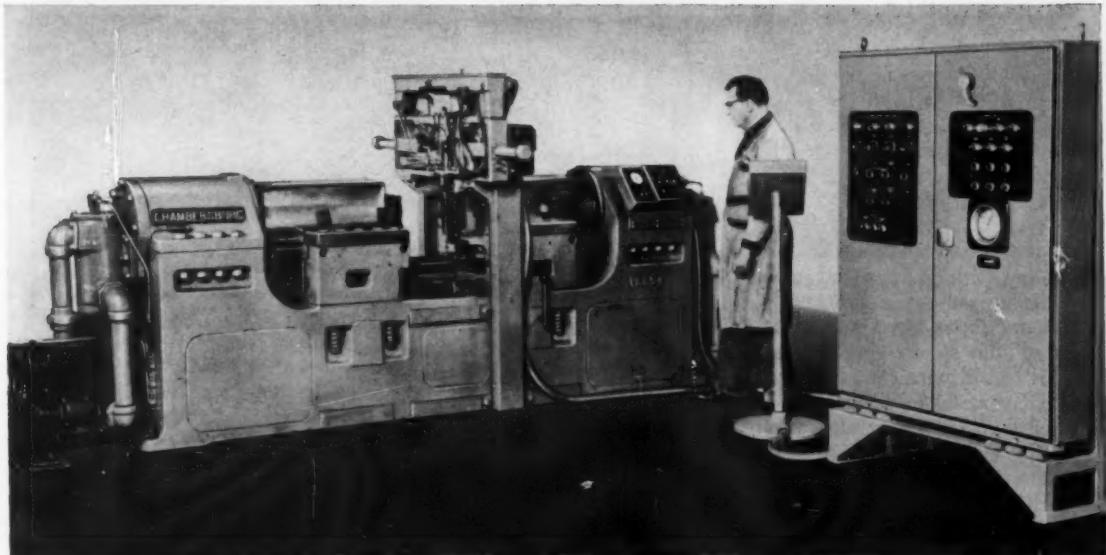


Fig. 2. Semiautomatic Cecomatic process unit with Model C Impacter and program-controlled feed

duced with this equipment about to be released by the gripping tongs.

The process is based primarily on Chambersburg's revolutionary horizontal type hammer, the Impacter. The Model C, which was particularly developed for jobbing type production, has striking rates much greater than those of ordinary hammers. This speed permits the rapid working of the forging stock, which is manipulated through the various die impressions by the fast-moving traveling tongs of the program-controlled feed device. The feed mechanism locates the stock accurately in the stop and forging positions and is capable of rotating it between Impacter blows. Thus the complicated manipula-

tions which a forger uses to work stock through a succession of die stages in a hammer or press are readily duplicated.

The brain of the process is the comprehensive control panel, on which are mounted all the selectors and electrical controls. Programs can be standardized to make a particular forging with the greatest economy. The unit is equipped for five separate die stations in the Impacter's die area, at which up to ten blows of preselected energy may be struck. Changes in program are quickly made even while the process is in operation. Either numerical, manual, tape, or card control can be applied.

The Cecomatic process is being offered as an integrated produc-

tion unit complete with a gas-fired furnace designed expressly for the rapid heating of cut lengths of bar stock. Forging dies are available as an extra if a unit completely equipped for service is desired.

The die faces of an Impacter, being vertical, enhance the removal of scale from the impressions between forging blows, reducing scale impregnation and improving the surface finish of the forging. Dies run cooler in the Impacter because they are in contact with the heated stock for a mere fraction of a second. This minimum die contact reduces the risk of heat checking. A two-man crew can usually make a complete change-over from one job to another in less than an hour without

cooling down the furnace. Changing jobs means merely changing dies, setting up the new program on the control panel, and adjusting stock grips and handling devices.

A semiautomatic Cecomatic process with Model C Impacter and program-controlled feed device which can be loaded by the operator with stock from a conventional furnace is shown in Fig. 2.

Circle 575 on Readers' Service Card

Ellis Two-Way Rotary Table

A 9-inch, two-way rotary table, designed for either horizontal or vertical mounting, is the latest addition to the Ellis line of precision machine tool accessories distributed by the Nichols-Morris Corporation, White Plains, N. Y. The right-angle base is a high-strength, stress-relieved semisteel casting which has both faces ground to insure trueness in either position.

The one-piece worm and shaft, made of alloy steel and ground all over, is run in with the precision-hobbed worm-wheel, which has a ratio of 90 to 1. Adjustment is provided to eliminate backlash. To facilitate setups, the worm and worm-wheel may be quickly disengaged for freewheeling. The table circumference and the hand-wheel dial are graduated.

A crank indexing attachment is optionally available for all divisions up to 100, with a floating



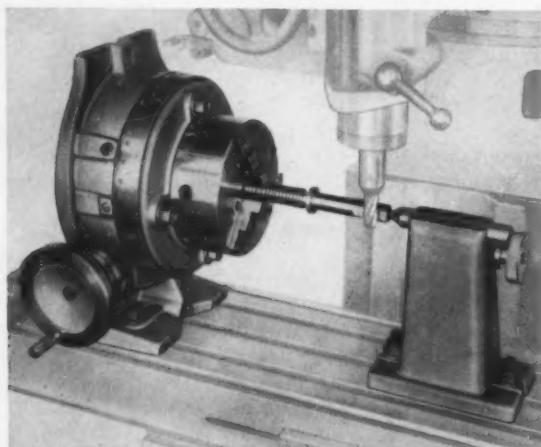
Fig. 3. Scissors forgings automatically produced in a three-impression die of Cecomatic unit about to be released from gripping tongs

index-plate and a graduated holder which greatly simplify setting up work. When used in the horizontal position, over-all height of the table is only 3 3/4 inches, and when used in the vertical position, the rotary table will swing work up to 14 inches in diameter. Tailstock and fitted chucks are available as extra equipment.

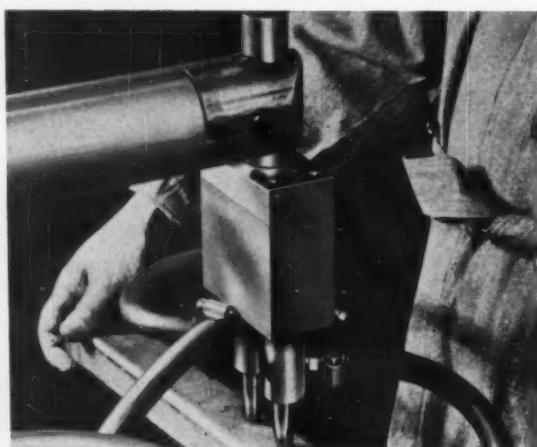
Circle 576 on Readers' Service Card

Dual Spot-Welding Tip Holders that Exert Equal Pressures

A dual spot-welding electrode holder, called the Equa-Press, has been announced by Air Reduction Sales Co., New York City. This holder automatically exerts equal forging pressures through its two



Ellis two-way rotary type table now available from the Nichols-Morris Corporation



Equa-Press dual spot-welding electrode tip holders recently announced by Air Reduction Sales Co.

tip-holding barrels regardless of minor variations in work thickness or electrode wear. The equalizing mechanism is purely mechanical and provides maximum conductivity through its working parts.

A water-cooling system is incorporated in the holder. The use of offset tips gives a range of distances between welds of from 0 to 4 inches. Models are available for mounting in a welder arm or for bolting to a press welder platen. Reduced welding time for a given number of welds with good weld uniformity and precise spacing between welds are benefits claimed for the new dual holder.

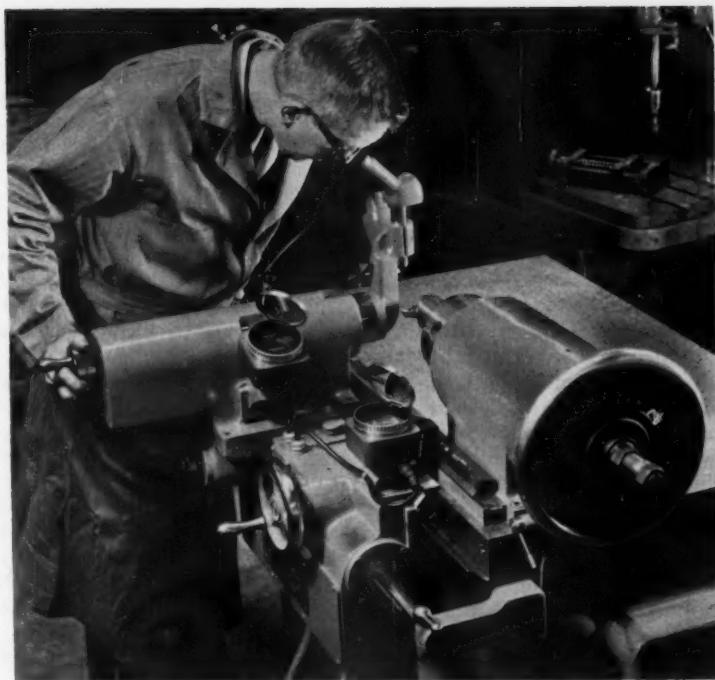
Circle 577 on Readers' Service Card

Precision Tool-Presetting Machine

A machine designed to preset precision cutting tools to rigidly accurate tooling requirements of numerically controlled machine tools is announced by the Microbore Division of DeVlieg Machine Co., Royal Oak, Mich. This machine enables cutting tools to be preset for both diameters and depths to precise tolerances, handling boring-bars, milling cutters, drills, and other accessory tooling. In reality, it is a combination high-precision instrument built on a machine tool type, rigid cast-iron base. The unit is 46 inches long, 44 inches wide, and 50 inches high. It includes a surface-plate area of 24 by 36 inches on top of the base, and offers a maximum tool-setting capacity diameter of 8 inches and a maximum depth from the gage line in the taper socket of 18 inches.

The precision presetting spindle mounted on the base is arranged with transverse- and longitudinal-slide adjustments. The presetting spindle is equipped with a combination No. 50 NMTB and No. 50 Flash-Change taper, as well as a handwheel for manual rotation. It also is mounted on the precision-scraped surface plate on top of the base, to provide maximum precision settings. The surface plate allows ample working area for auxiliary setting equipment.

The two coordinate positioning slide elements consist of a saddle



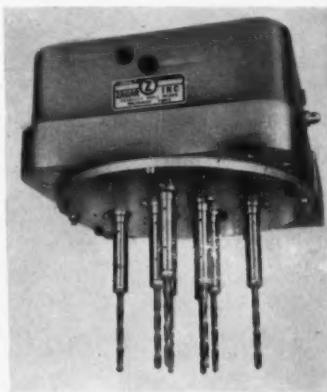
Illuminated microscope with special cross-hair reticule on precision tool-presetting machine developed by Microbore Division of DeVlieg Machine Co.

mounted on dovetail and flat ways, with longitudinal movement parallel to the spindle axis, and a transverse-slide member moving on cylindrical guide ways normal to the spindle axis. The slide elements are equipped with Vernac direct-reading optical measuring instruments. These can be read directly to 0.0001 inch without interpolation.

One Vernac instrument, mounted on the transverse slide, provides for control of diameter

settings. The other, mounted on the longitudinal slide, provides for the setting of length or depth. Coarse and fine handwheel controls guide movements of both slides. A Bausch & Lomb 40-power, illuminated microscope with special cross-hair reticule is mounted on the slides for optical sighting of the tool point. The machine can be easily adapted for presetting tooling with shanks other than those mentioned.

Circle 578 on Readers' Service Card



Zagar multiple-spindle gearless drilling head

Zagar Multiple-Spindle Gearless Heads

Slip or cartridge type spindles are now offered on the multiple-spindle gearless heads for drilling, reaming, and tapping made by Zagar, Inc., Cleveland, Ohio. The slip-spindles are driven by the standard Zagar gearless method. The plate into which the spindles are inserted is prebored to accept spindles in varying patterns. Consequently, it is a simple matter to insert and remove spindles but retain the rigidity and accuracy of fixed center drilling.

The absence of gears and joints

permits a comparatively reduced over-all height of the head, enhancing its adaptability. A minimum of spindle extension is required, thus making an over-all height of 7 3/4 inches possible in

the smallest head size. Four standard head sizes cover maximum bolt-circle areas of 6 1/2, 10 1/2, 12 1/2, and 15 1/2 inches. Spindle sizes are 1 1/4 and 1 1/2 inches, with capacities for drilling up to

9/16-inch holes in steel. The standard heads are mountable on round or flange type quill machines.

Circle 579 on Readers' Service Card

Leitz Toolmaker's Microscope

The Leitz line of toolmaker's microscopes introduced by Opto-Metric Tools, Inc., New York City, has been enlarged by the addition of an entirely new model, which combines an increased range of 3 by 8 inches, a purely optical measuring stage, and a binocular microscope tube. It is claimed that the extended range of this instrument, Fig. 1, places it in a class with similar universal measuring machines, in spite of its much lower cost. This claim is supported by the design of the heavy stage which resembles a machine tool table rather than a microscope stage.

A unique feature is the 3- by 8-inch master scales that are read directly in 0.0001 inch through a single projection window, Fig. 2. These scales make the measuring operation in both directions fully continuous and extremely simple, since no gage-block dimensions have to be added to or subtracted from the scale readings.

An even more important innovation is represented by the binocular intermediate image tube, which retains the 1-to-1 ratio relay system of the standard Leitz tube, plus a second relay ratio of 5 to 1. With the same optics, two series of magnifications become avail-

able as 10X, 20X, and 30X, as well as 50X, 100X, and 150X. The second series of higher magnifications should be most useful in meeting the ever widening need for critical measurements required by the miniaturization program.

In addition to the greater con-

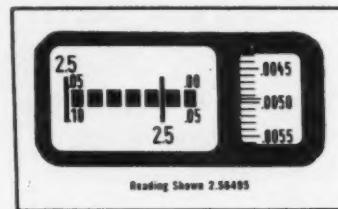


Fig. 2. Projection window of instrument shown in Fig. 1



Fig. 1. Leitz toolmaker's microscope introduced by Opto-Metric Tools, Inc.

venience of binocular observation the new tube features 1-to-1 ratio thread and radii charts, internal protractor reading in one minute, and a double-image adapter in complementary colors for checking center distances of holes.

Circle 580 on Readers' Service Card

Oxy-Fuel Gas Gouging Nozzles

Two-piece gouging nozzles designed for use with natural gas and propane have been introduced by the Linde Company, division of Union Carbide Corporation, New York City. These nozzles are said to produce greater preheat than heretofore possible when using natural gas or propane. They are ideal for gouging heavily scaled or rusted plate.

The design of the new nozzle, designated the Oxweld 1542 series, incorporates a slotted internal nozzle with an external sleeve. The slotted design provides a greater number of individual small flames with the highest gas velocity which combine to produce a high-intensity



Linde Oxweld gouging nozzle

flame. Excellent stability prevents the high velocity preheat flames from blowing off. Gouging starts have been obtained in four seconds with these Oxweld nozzles.

Internal surfaces of the copper external sleeve and brass internal section are chromium-plated for improved corrosion resistance and longer service life. New gouging nozzles are available in bent form or straight—depending on the specific application. Internal and external members of bent nozzles can easily be separated for easy maintenance and removal of slag.

Circle 581 on Readers' Service Card

Oliver Drill-Pointing Machine

The Oliver Instrument Co., Adrian, Mich., has announced a completely new drill-pointing machine, designated Model 600. This latest addition to the company's line of toolroom equipment is now available in three styles. It incorporates improvements based on the vast accumulated experience gained through the production of thousands of preceding drill pointers. The most evident change is the completely new exterior styling. The major mechanical change is the addition of a thoroughly tested scroll type chuck. Antifriction bearings and an automatic recirculating lubrication system insure long life.

The chuck is controlled by a quick-acting positive drive which eliminates the former telescoping universal joints. The construction of the quill and clutch as one integral part makes it impossible for the unusual grinding motions to get out of time. The chuck is easily adjustable, permitting accuracy to be maintained over a long period.

Another important change is the grouping of all controls at the front of the machine to facilitate operation. Because of the greater horsepower now available for drilling operations, the range of

lip clearance has been increased approximately six times. This means that heavier feeds can now be used with the Oliver type point to increase production.

The Model 600 drill pointer is available in the dry type; the wet type, for use with very large drills or where excessive stock removal is required; and the Airdraulic type, which is fully automatic after setup. The unit will grind right-hand drills in the two-, three-, or four-flute style in a size range of $1/2$ to 3 inches in diameter. All flutes are ground in one continuous motion. The variable clearance and variable included point angles of 80 to 160 degrees are instantly obtainable. A theoretically perfect drill point is created which is said to afford the user a reduction in both torque and thrust of about 25 per cent.

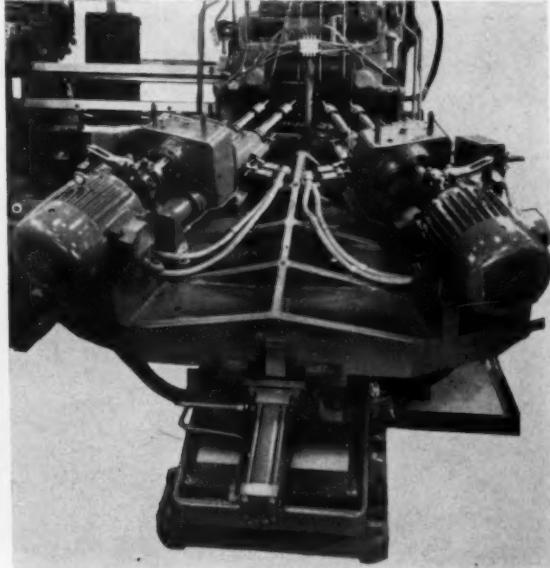
Circle 582 on Readers' Service Card

Foote-Burt Dual-Headway Unit

A unique dual-headway unit is announced by the Foote-Burt Co., Cleveland, Ohio. This unit was developed to tap spark-plug holes in aluminum cylinder heads for a high-speed, ninety-station transfer line. By doubling up two



Drill-pointing machine built by Oliver Instrument Co.



Dual-headway unit announced by the Foote-Burt Co.

individual lead-screw tapping units on a single hydraulically actuated feed carriage, the length of the line was shortened by two stations and one transfer operation was eliminated, saving space and cutting production cost.

The dual-head spindles are located at an included angle of 46 degrees and are angled 23 degrees downward. The angular lead-screw tapping units are independently driven. Hydraulic fast feed brings up the carriage bed on square ways. The opposed-head

spindles then advance alternately to tap the work. At the correct depth, an electric brake stops the taps instantly, and the feed reverses automatically to back out the taps. The other head then runs through its cycle; alternate operation avoids interference. Present tapping speed is 300 fpm for aluminum. However, speeds as low as 70 fpm for cast iron can be obtained by simply replacing the drive-shaft and intermediate gears.

Circle 583 on Readers' Service Card

Cincinnati Heat-Processing Machines

The Meta-Dynamics Division of Cincinnati Milling Machine Co., Cincinnati, Ohio, displayed four interesting heat-processing machines in operation at a recent ASTME show in New York City. Three of these, 1-kw and 5-kw Inductron induction-heating machines and a No. 1 Flamatic flame-heating machine, were shown for the first time. The fourth, a 15-kw Inductron MG induction-heating machine has a new low-cost, high-frequency alternator system which does not require water cooling and which occupies considerably less floor space than previous models. The Flamatic machine, Fig. 1, which was set up for hardening the teeth on an automotive transmission gear, was built up

from Cincinnati's new building-block system, which permits specific machines to be assembled from a wide variety of standard, interchangeable units. In this case a self-contained No. 1 Flamatic flame-heating unit, with the necessary retractable, rotating work-spindle and standard flame heads, was combined with a self-contained conveyor type quench tank. The quench tank is one of a series of standard basket type and conveyor type quench tanks which may be used with either Flamatic or Inductron heating units. The No. 1 Flamatic flame-heating unit employed incorporates precise control of fuel gas, oxygen, air, water, and primary electric power. The wide range of accessory

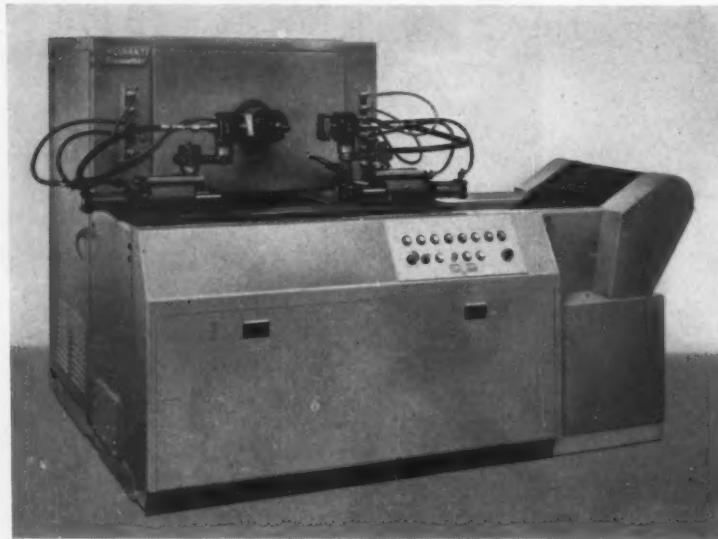


Fig. 1. Flame-heating machine assembled from Cincinnati standard building-block units



Fig. 2. Cincinnati portable, bench type induction-heating unit of small capacity



Fig. 3. Cincinnati 5-kw RF Inductron bench type unit adaptable to wide range of hardening, annealing, brazing, shrink fitting, and similar work

equipment available includes electronic temperature control, rotary flame head, and a wide variety of work-holding and automatic work-handling fixtures. The self-contained quench tank includes automatic circulation and agitation of the quench medium, a heat exchanger, and a motorized conveyor for the automatic removal of parts

The 1-kw RF Inductron, Fig. 2, is a new radio-frequency induction-heating machine of the small capacity required in the manufacture and assembly of small instruments, electronic components, jewelry, and similar applications.

The 5-kw RF Inductron, Fig. 3, is a compact, self-contained, bench type radio-frequency induction-heating machine that is easy to move from job to job, and can be incorporated directly in production lines to reduce work-handling to the minimum.

Circle 584 on Readers' Service Card

Photocell Reader for Punched Tape

A photocell reader that reads punched tape at the rate of 300 characters a second has been announced by the Rheem Mfg. Co.'s Electronics Division, Los Angeles, Calif. This new high-speed reader, known as Model RR-300, is believed to be unique in its price range and in the fact that it includes output amplifiers for all tape channels. Light shining on a solar cell is converted to current, and this is amplified within the unit.

The Model RR-300 is the latest of Rheem's line of readers and was developed to meet the many requirements of industry for a low-priced, relatively high-speed reader. It is available in either a desk top or rack-mounted unit.



Rheem photocell reader for punched tape

The readers are completely transistorized for long life. The sensing element is one piece of silicon containing eight information and one timing track channels. This eliminates focusing problems often

encountered when each channel uses its own photocell as a sensing element. The units have few moving parts and no contacts to wear out or give faulty readings.

Circle 585 on Readers' Service Card

Kendex Adjustable Units with Throw-Away Inserts and Small Boring-Bars with Solid Kennametal Shanks

Standardized Kendex units, see Fig. 1, that provide a versatile, economical "building-block" approach in tailoring special tools for boring, chamfering, and facing operations were introduced by Kennametal Inc., Latrobe, Pa., at the recent ASTME Tool Exposition in New York. These adjustable units for "Kendex Tailored Tooling" utilize standard Kendex throw-away inserts.

Quick, two-way adjustments of bore diameter and shoulder length

provide for precision tolerances that can be maintained on critical-dimension work by microadjustment of a readily accessible screw to compensate for tool wear. The adjustability of these units also permits dimensional changes without requiring a new tool. The units are available with rake and lead angles that meet a wide range of job requirements. Another type of Kendex unit, with radial adjustment and positive rake only, is available.

The Kendex BB-7000 K-Bars, Fig. 2, also introduced at the exposition, are small boring-bars with solid Kennametal shanks which have three times the rigidity of steel. Five sizes of these K-Bars, with diameters of 3/8, 1/2, 5/8, 3/4, and 1 inch, supplement Kennametal's Style BB-5000 Kendex adjustable K-Bars in the 1- to 2 1/2-inch diameter sizes. Respective lengths of the small BB-7000 K-Bars are 6, 8, 10, and 12 inches. Standard triangular Kendex inserts and chip-breakers are used with these bars.

Designed for precision tooling



Fig. 1. Two-way, adjustable Kendex units designed for economical building of multiple-insert bars and heads

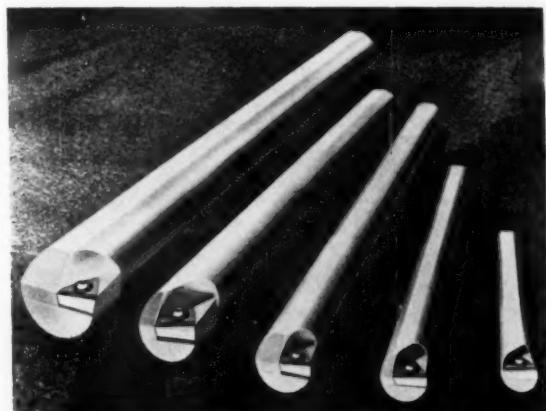


Fig. 2. Kendex BB-7000 K-Bars, with diameters ranging from 3/8 to 1 inch, which have extra-rigid solid shanks



Wilson Specialty reports longer tool life, with Gulfcut® Heavy Duty Soluble Oil ...

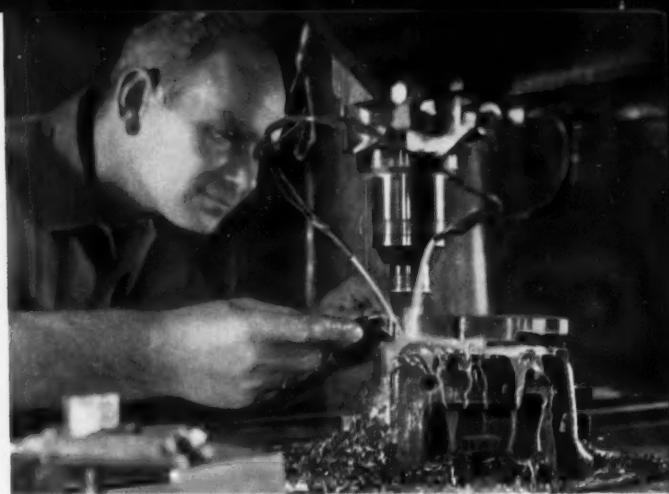
It's no easy task to machine an actuator support fitting assembly for a B-58 supersonic jet bomber. This calls for a company with a first-rate reputation in tough, complex machining jobs. The Wilson Specialty Manufacturing Company, Fort Worth, Texas, is such a company!

"Quite often, we find ourselves working with Titanium alloy and VascoJet 1000—two expensive ma-

terials," says Roy Watson, President. "And naturally, we've got to have a coolant which removes heat swiftly and gives us good tool life and a fine finish.

"Needless to say, we're fussy about cutting oils. In fact, we tried more than 8 different coolants before we settled on Gulfcut Heavy Duty Soluble Oil.

"We've found that a mixture of 20 parts water to one part oil provides effective cooling and lubricity



End milling Titanium alloy on a 3-dimensional Hydro-Version Arrow Profiler. The part is an actuator support fitting assembly for a B-58 jet bomber. The coolant is Gulfcut Heavy Duty Soluble Oil.



Roy S. Watson, right, President of Wilson Specialty, shows Frank P. Mauro, Gulf Sales Engineer, a Titanium part. Wilson Specialty tried 8 cutting oils—found Gulfcut Heavy Duty Soluble Oil to be the best!

◀ Milling groove in B-58 actuator support fitting assembly. Gulfcut Heavy Duty Soluble oil has improved tool life and increased feeds and speeds.

higher feeds and speeds GULF MAKES THINGS RUN BETTER!

in our operations. Tools last longer. Feeds and speeds are higher. And our rejection rate is lower. Gulfcut Heavy Duty Soluble Oil deserves much of the credit."

If you're faced with a stubborn machining problem, give us the opportunity to show you how Gulf makes things run better! Call a Gulf Sales Engineer at your nearest Gulf office. Or write for Gulfcut literature.

GULF OIL CORPORATION

Dept. DM, Gulf Building
Houston 2, Texas

SP - 10106



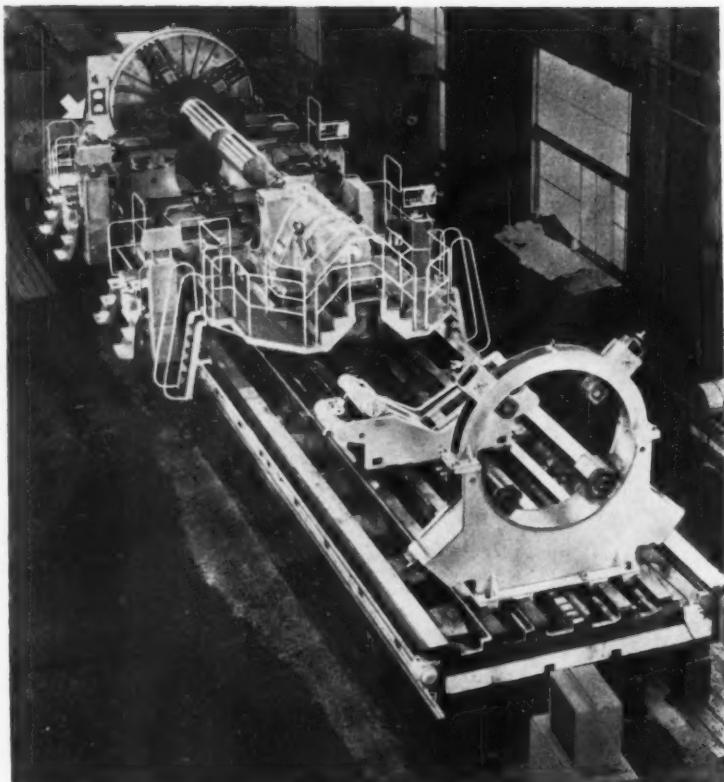
to produce better finish and straighter holes, Kendex K-Bars are said to practically eliminate chatter and greatly reduce vibration and deflection. The new BB-7000 K-Bars were also displayed for the first time at the exposition.

Circle 536 on Readers' Service Card

Huge Electronically Controlled Lathe

An electrically controlled lathe of gigantic proportions has been designed and built by Baldwin-Lima-Hamilton Corporation's Industrial Equipment Division, Eddystone, Pa., for the Bethlehem Steel Co. This lathe will turn work-pieces up to 9 feet 2 inches in diameter and to 45 feet in length. It can support pieces weighing up to 240 tons without the need for supplemental steady-rests. The illustration shows the giant size lathe undergoing final manufacturing checks before shipment to Bethlehem's Lehigh Division machine shops at Bethlehem, Pa.

The lathe has a 110-inch diameter faceplate with 139-inch swing over the bedways. The lathe bed, 64 feet long, is equipped with two front and two rear carriages with push-button, electronic feed and traverse controls. These carriages are capable of operating independently or simultaneously with



Electronically controlled lathe of gigantic size built for Bethlehem Steel Co.
by Baldwin-Lima-Hamilton Corporation

feeds infinitely and independently variable from 0.005 inch to 1 1/4 ipr of faceplate. Spindle speeds can be varied from 1/4 to 50 rpm.

The main drive motor has a rating of 250 hp. Note relative size of operator (arrow, upper left).

Circle 587 on Readers' Service Card

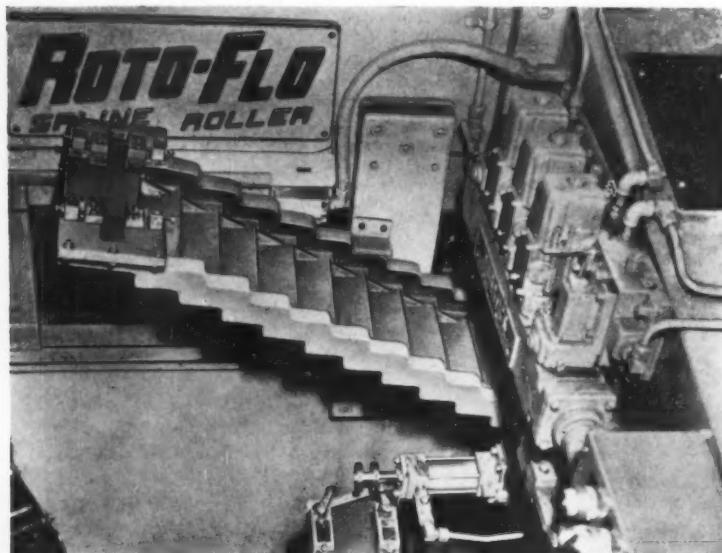


Fig. 1. Typical application of new device that delivers unthreaded shafts to Roto-Flo machine in baskets on a roller conveyor

Automatic Loader for Slender Parts

An automatic device, designed and built by Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich., loads, locates, and unloads long slender parts in production machines quicker and easier than could be done manually. This device has been specially designed to prevent jamming or damage of the parts. Blank work-pieces are introduced at the top of a new "waterfall" type chute, Fig. 1, that prevents an excessive rolling speed or jamming of the shafts. Each time they go down a step, the shafts are slowed and straightened across the chute.

The chute leads to a barrel-shaped escapement mechanism

MACHINERY'S DATA SHEET

SPRING DESIGN DATA—5

Close-Wound Extension Springs—Graphical Description of Load-Deflection Characteristics

August Data Sheet-3, Spring Design Data, explains how a compression spring reacts when load (P) is applied causing it to deflect or compress. This explanation is presented in the form of a graphical description of the load deflection characteristics of the spring.

In the same manner — by a graphical description of load deflection characteristics — we can explain how a close-wound extension spring reacts when load is applied causing it to deflect, or extend.

As mentioned in July Data Sheet-1, in which typical extension springs are illustrated, helical coil extension springs store energy by being forcibly stretched along the axis of winding. When permitted to release this energy, they contract in length and exert a pull. On extension springs, hooks or other means of attachment to the members being drawn together, must be provided.

The relation of the load to the deflection of the spring, the spring "gradient" (K), is usually expressed in terms of pounds per inch of deflection and the relationship can be plotted as illustrated by the sloping straight line in Fig. 1 and by line K in Fig. 2.

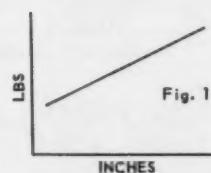


Fig. 1

The slope of line K can be calculated when certain dimensional characteristics of the spring are known and used. However, since we are not now concerned with calculations or methods, it is sufficient for our present purposes to state that: (1) when the loads desired in a spring are known, the slope of line K can be calculated; or (2) when the slope of line K is known, loads can be calculated.

Referring to the graphical description, Fig. 2, note that when no load is applied to an extension spring, the spring does not deflect, stores no energy, and is inoperative. In this inoperative position, the length, measured inside the hooks at the ends of the extension spring, is called "free length" (H). The over-all length of the active coils in the extension spring in this position is called "body length" (B) and is always a part of extension spring specifications.

Like all measurements in any manufactured product, free length will vary in springs. Since this "free length variation" (ΔH) affects other characteristics, it must be taken into consideration. For instance, note that when the starting point of the K line differs from that of other similar springs as a result of free length variation, the load (P_1 or P_2) at any desired length (L_1 or L_2) will also vary as shown by ΔP_1 (initial load variation) and ΔP_2 (final load variation). Also, variables in the spring will cause variations in gradient (ΔK) as shown by the difference in slope in dotted lines ΔK . This is explained under another subject.

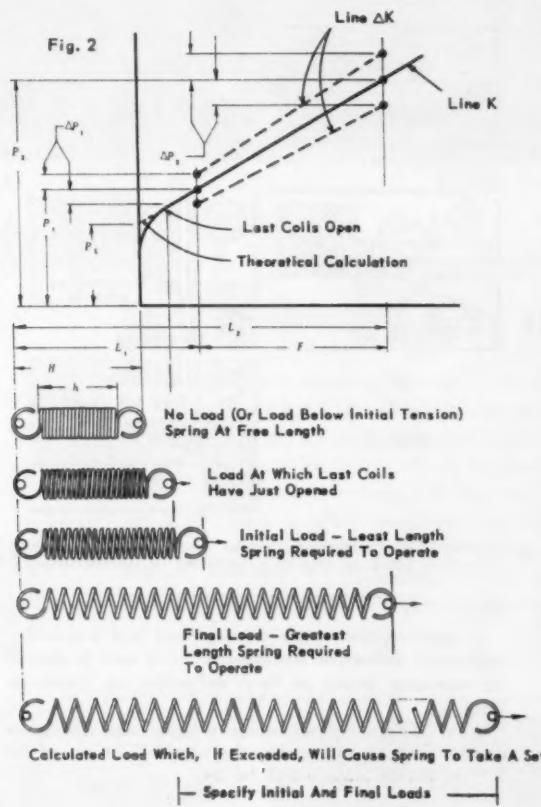
In a close-wound extension spring, the spring carries a "pre-load" or tension which has been wound into the coils during the coiling operation and which must be overcome before the coils will start to open. This pre-load, which must be overcome, is known as "initial tension" (P_i) and must be considered when designing an extension spring.

Further, from a practical standpoint, an extension spring cannot be made so perfect in every respect that all coils will open simultaneously upon the application of force. Actually, some of the coils will begin to open (become operative) before others. Therefore, within the area between the free length of the spring (no load) and the load at which the last coils have just opened and become operative, the operation of the spring is affected and line K cannot be expressed as a straight line — must be expressed as a curve as shown on Fig. 2. When a load is reached at which the last coils have just opened, line K is expressed as a straight line as shown. If continuing force is applied to the spring, beyond that for which the spring has been designed, the spring will, eventually, "take a set" (will not retain its original stress but will become deformed). The set takes place in the form of loss of initial tension without changing the initial gradient.

On the graph, Fig. 2, line K is also expressed as a straight, dotted line. This merely represents theoretical calculation based upon the premise that, if an extension spring could be made perfect in every respect, all coils would open simultaneously.

From the graphical description, it can be seen that test loads (P_1 and P_2) should be specified between two limits — the lower limit being the point at which all coils open (above initial tension) and the upper limit being a point safely below a load at which spring coils will set. The range between the operating loads (P_1 and P_2) is called "operating deflection" (F).

The spring application will, of course, determine the deflection and loads required and the other specifications of the spring. This is a part of spring design and is explained under other subjects.



Courtesy of Spring Division, Hunter Spring Co., Lansdale, Pa.

MACHINERY'S DATA SHEET

SPRING DESIGN DATA—6

Close-Wound Extension Springs—the Eight Ways to Specify

The first action to take when starting close-wound extension spring specification or design is to determine which load, the initial load or the final load (P_1 or P_2 refer to Design Data-5) is of greater importance in the particular application for which the spring is intended. When the most important of the two loads has been determined, it is then referred to as the "primary" load and the other load becomes the less important, or the "secondary", load. (An example of designating primary and secondary loads can be found in Aug. Data Sheet-4, of Spring Design Data.) In some instances, the initial load may be determined to be the primary load and the final load the secondary load. In other applications, the reverse is often true—the final load might be primary and the initial load secondary.

After selecting a primary operating load at desired length (P at L), the operating deflection (F) should be fixed and, when required by the application, the second load should be determined. This can be done in one of 8 ways as shown in the illustrations. Case I applies where final load is primary, and Case II where initial load is primary.

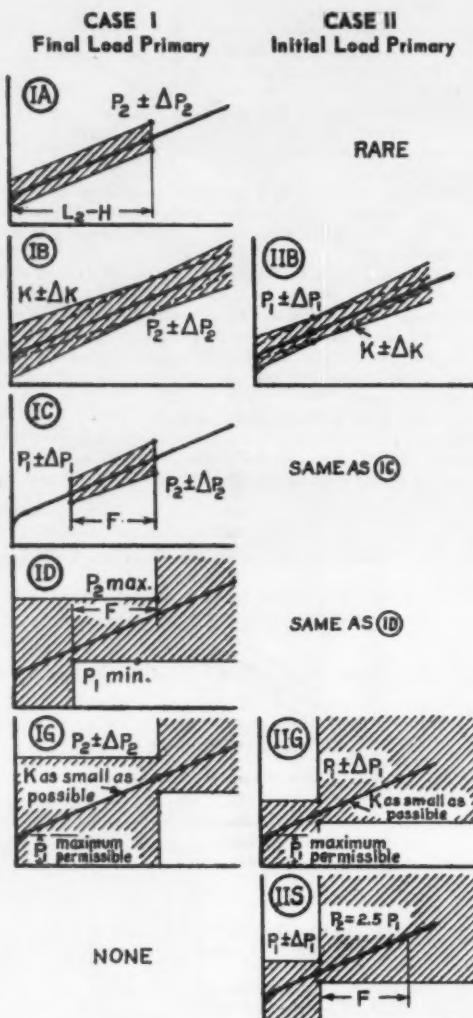
Frequently, only one load is important in specifying a spring. When this is so, a suitable length, reflecting the desirable length characteristics of the spring at free length (H) and at the length at final load (L) should be determined and should be made the second, required factor for fixing the load-deflection of the spring—remembering, however, that some initial tension is desirable. This is illustrated in Case IA.

Or, an application may be such as to require one important load (primary load) and a specified gradient (K). In this case, the gradient requirements will fix the second load and the spring deflection (F) as shown in Cases IB and IIB.

Sometimes, because of application requirements, it may be desirable to specify a primary and a secondary load. Given these specifications, gradient can be calculated and deflection determined as shown in Case IC. However, do not make the tolerances for secondary load unduly restrictive because this can involve additional testing and inspection and the use of special manufacturing techniques on the part of the manufacturer which add to cost.

Some applications demand control of both loads, but only the outer limits. In such instances, there is a minimum requirement at L_1 and a maximum requirement at L_2 . Springs can be made to meet these requirements as shown in Case ID. The gradient could be very flat and still suit this application.

When the application requires the softest possible spring (both loads as close together as possible), the gradient should be made as small as possible by basing the design upon using the greatest possible initial tension (P_1) and the smallest possible wire size (d). Cases IG and IIG illustrate this.



(Sectioned area represents normal variation (Δ). Any load deflection curve in this area conforms to specifications.)

In applications where primary load and a specific additional deflection are required, it is well to design for minimum stress at final deflection as shown in Case IIS.

After the spring requirements have been placed in one of these 8 categories, the way will be paved for further design steps which follow.

Courtesy of Spring Division, Hunter Spring Co., Lansdale, Pa.



Checking centerless ground parts with Starrett No. 483 V-Anvil Micrometer.

Starrett® v-anvil micrometer spots centerless grinding errors

Starrett V-Anvil Micrometer No. 483 with 3-point contact spots out-of-roundness errors other mikes miss, warns centerless grinder operators to adjust the machine, saves making costly scrap. Also measures 3-fluted cutting tools — taps, milling cutters, reamers. (V-Anvil Micrometer No. 485 measures 5-fluted cutters.) Carbide-faced anvils and spindle guard its precision under abrasive con-

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World's Greatest Toolmakers



No. 220 MUL-T-ANVIL MICROMETER used for measuring wall section of part with eccentric hole, distance from blind slot to edge, and flange thickness using "V" anvil.



that has four axial slots along its periphery, Fig. 2. As the barrel indexes, one part enters the slot and is rotated upward 90 degrees to the loading position. The blank is picked up by live headstock and tailstock centers and inserted into the machine.

After the part has been processed, the headstock and tailstock return it to the same slot in the barrel. Following the next index, the finished part rolls out of the barrel and slides down to a belt conveyor. All loader and machine motions can be electrically interlocked through limit switches, so that the complete cycle is automatic.

A typical application, Fig. 1, shows the new loader adapted for handling lower-control-arm shafts of steering mechanisms. Blank shafts are loaded into a Michigan Tool Co.'s Roto-Flo machine, where four threads—two each of two diameters—are cold-rolled in a single pass of the forming racks.

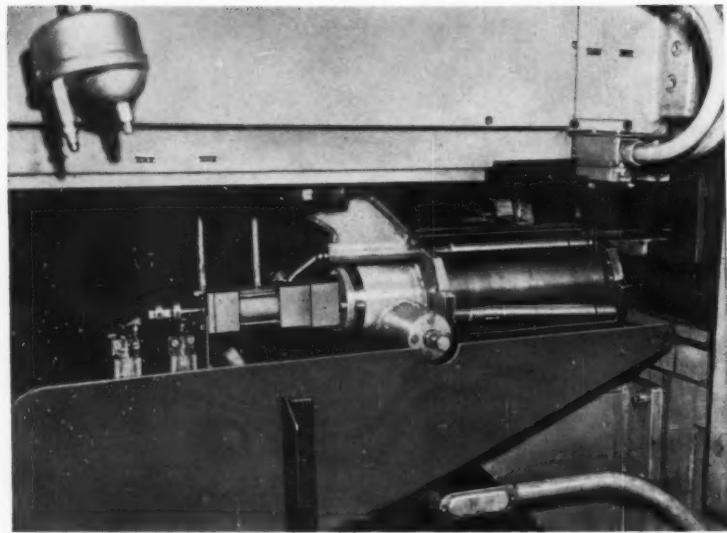


Fig. 2. Gear-O-Mation automatic loader with barrel-shaped escapement that takes shafts out of the chute in axial slots. Tailstock is about to load a blank shaft into a Roto-Flo, while a threaded shaft rolls out of the barrel

Without automatic loading equipment, production would be about 300 shafts per hour. With the

loader, production has been raised to 470 shafts per hour.

Circle 588 on Readers' Service Card

Ther-Monic Equipment for Brazing Steel Casting to Steel Tubing

Induction Heating Corporation, Brooklyn, N. Y., subsidiary of Hathaway Instruments, Inc., has announced a fixture and coil arrangement designed to increase the versatility of its production processing equipment. This new device is able to braze steel castings onto 3-inch diameter steel tubing on a "three-at-a-time" basis in just thirty seconds. The fixture itself consists of an aluminum platform which is raised by an air

cylinder on which are mounted three transite cups for positioning the work, base down. A three-position, single-turn, low-voltage type work-coil serves all three locations.

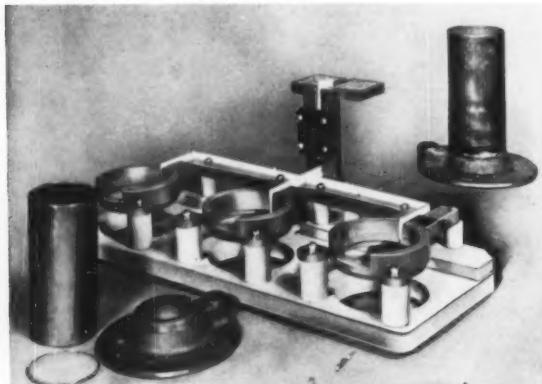
In operation, the work is mounted 180 degrees from that shown in the illustration. The operator inserts the base so that the notch in it engages the open-cut portion of the work-coil. The silver-brazing alloy ring is inserted;

then the tube portion to be brazed is put in place. After brazing, the parts are water-cooled.

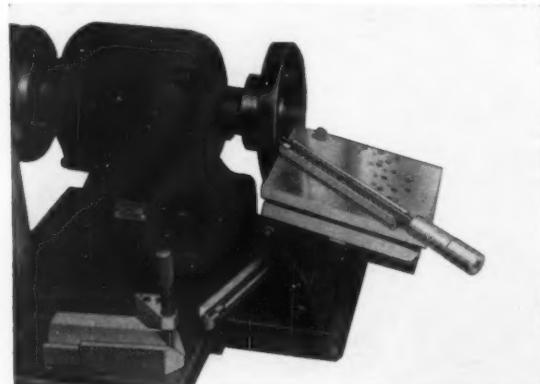
Circle 539 on Readers' Service Card

Fixture for Grinding Gun-Drill Noses

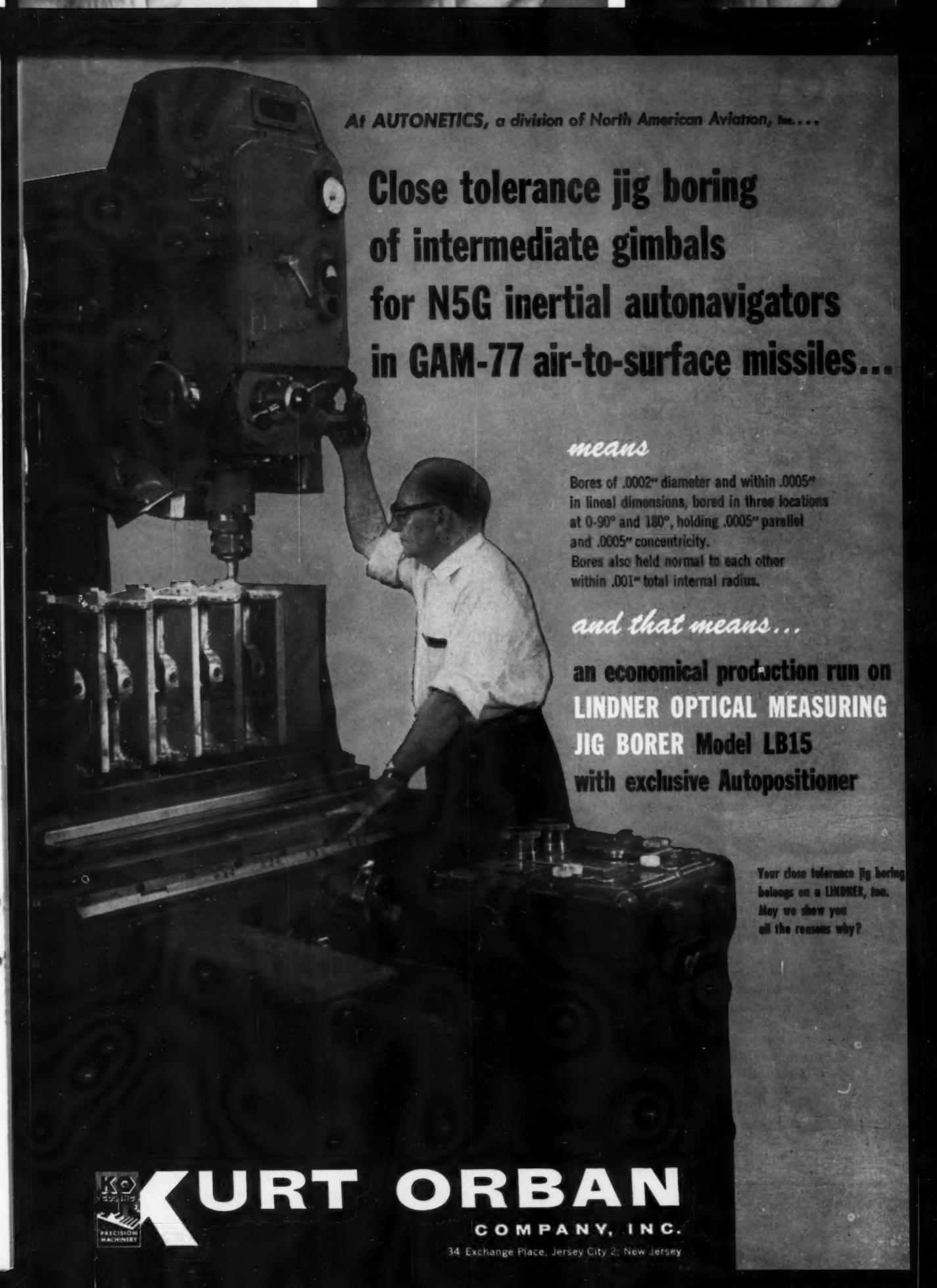
The grinding of gun-drill noses has been simplified by the development of an easily operated rocker-base fixture engineered by the Eldorado Tool & Mfg. Corporation, Milford, Conn. This fixture can be used on any simple bench



Ther-Monic brazing fixture with three work-heating coils



Eldorado grinding fixture for sharpening gun-drill noses



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means

Bores of .0002" diameter and within .0005"
in lineal dimensions, bored in three locations
at 0-90° and 180°, holding .0005" parallel
and .0005" concentricity.

Bores also held normal to each other
within .001" total internal radius.

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Your close tolerance jig boring
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all the reasons why?



COMPANY, INC.

34 Exchange Place, Jersey City 2, New Jersey

or pedestal grinder equipped with a diamond wheel. By following the step-by-step numbered directions that come with the fixture, it is said that the user is able to improve tool efficiency, as well as prolong the life of the drill.

The fixture has two parts—a rocker base that is set on the grinder's angle table and a block for holding the gun drill securely on the fixture. The rocker takes care of the traverse for grinding. Two types of drill-holding blocks are available. A block with micrometer stop accommodates drills of 0.2500 to 1 inch in diameter. Individual blocks, for specific gun drills, are available for sizes between 0.078 and 1 inch in diameter, inclusive.

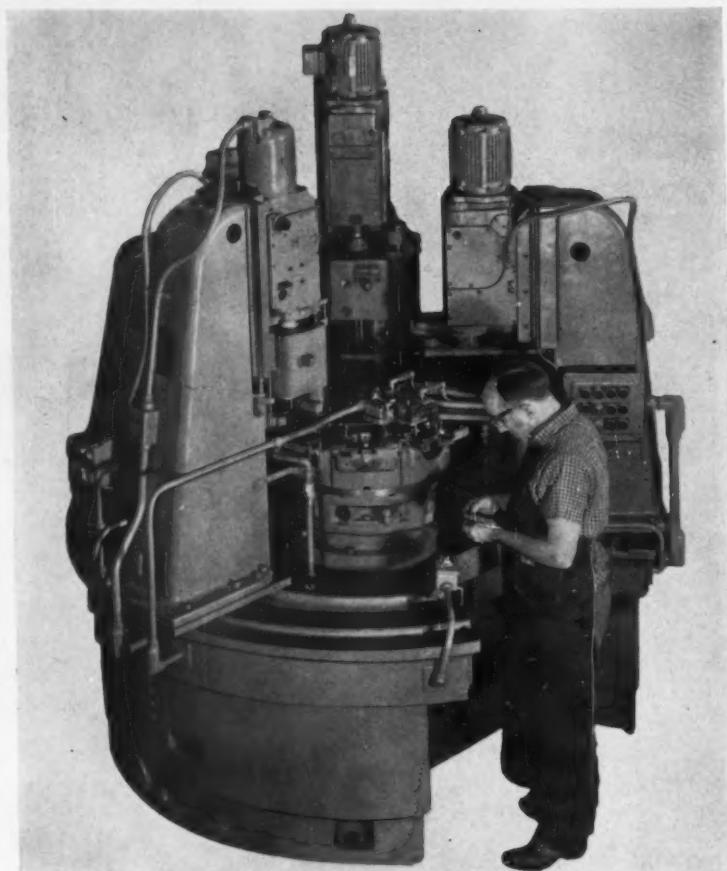
Circle 590 on Readers' Service Card

Kingsbury Machine Produces Mounting Bases for Power Transistors

Copper mounting bases used in power transistors are being machined at the rate of 800 parts per hour on a machine built by the Kingsbury Machine Tool Corporation, Keene, N. H. Five units with nine spindles perform the required drilling, counterboring, chamfering, and threading operations on these small copper parts. A 24-inch index-table holds eight work-fixtures equipped for automatic clamping, unclamping, and ejection of the work-pieces to achieve the high-production rate.

A work-piece is located in each fixture with its stem pointing upward. Two sliding jaws locate and clamp the work firmly on the large diameter so that it will not turn. This clamping action takes place automatically as the fixture indexes away from the loading station and is controlled by a stationary cam mounted on the center stud of the machine. The work-piece is unclamped in a similar manner as it is indexed to the ejection station.

There are five vertical units, the first four of which operate on three small holes. Of special interest is the unit in the rear, which has two multiple-spindle heads. The top head has three spindles, two for chamfering and one to



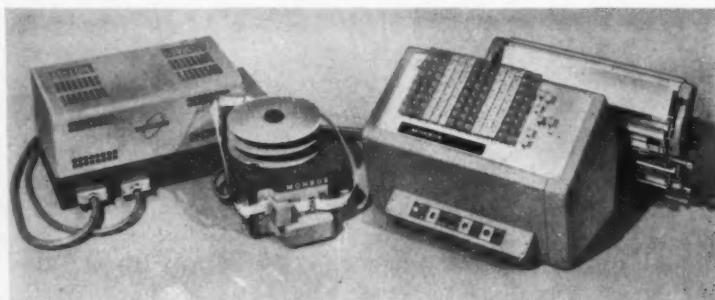
Machine built by Kingsbury Machine Tool Corporation for rapid processing of power transistor part

drive the lower head, which counterdrills two holes from underneath the work-piece. A walking-beam arrangement feeds both units at the same time—one down and one up. The last vertical unit on the right rolls the thread on the stem with a self-opening thread-rolling head.

Circle 591 on Readers' Service Card

Line Printers for Systems Equipped to Prepare Punched Tape

Two new line printers, designed for instrumentation systems, are available from the Electronics Components Division of Monroe Calculating Machine Co., Inc., San Francisco, Calif. The Model



Line printers designed for instrumentation systems, available from Electronics Components Division, Monroe Calculating Machine Co., Inc.



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MC 208 has both a manual and ten-wire input, without accumulation or with multiple accumulators. It has a tabulating programmable carriage for preparation of hard copy and punched tape, or punched card output. This same printer without punched output is known as the MC 206. Both printers accept data for logging, either electrically or by manual entry. Both models have self-contained timing relays for complete printer control, thus requiring only digit selection and function command from the source equipment, eliminating the need for pulse-length determination by the user.

The machine cycling speed is at the rate of 145 cycles per minute, printing only, or 60 cycles per minute, printing and punching a fourteen-digit word with automatic insertion of indicative codes. Complete specifications are given in product specification ECD 331 available from the manufacturer.

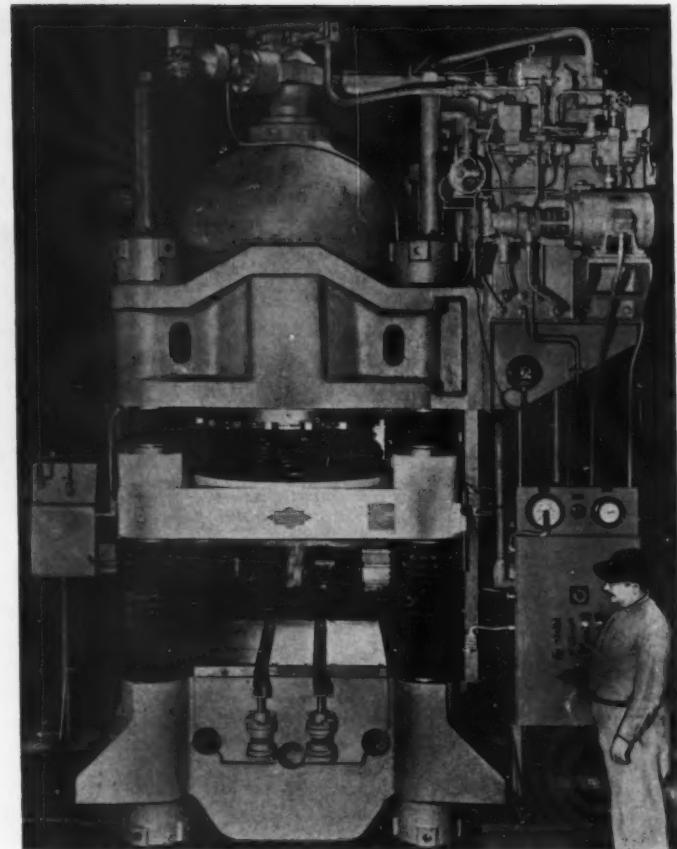
Circle 592 on Readers' Service Card

Powerful Hydraulic Press Built for Production of Grinding Wheels

An unusual type, two-station hydraulic grinding-wheel press that can be operated at different pressing strokes, tonnages, and daylight openings at each station has been built by the Birdsboro Corporation, Birdsboro, Pa., and is being readied for production by a leading grinding-wheel manufacturer. This 1600-ton press is a single-action, down-movement, four-column machine equipped with interlocking controls. These controls permit independent operation of each station at tonnages varying from 1600 down to 200 tons. Unique operating controls are also a feature of the press.

Each operator has a setup button which locks out the other station, thus preventing the second operator from taking control of the press operation. Also, an emergency return button is provided at each station so that either operator can, in an emergency, stop the press and automatically return it to its open and top position.

The working area of the press is



Birdsboro hydraulic press for use in manufacturing grinding wheels

41 by 41 inches. Maximum daylight capacity is 33 inches, and the maximum working stroke is 29 inches. All exposed, machined surfaces—such as rams, columns, and moving platen guides—are protected by an accordion type, zip-

pered closure boot. These protectors are made of a neoprene-impregnated material. The press is self-contained, with the hydraulic pumping unit mounted on top of the machine.

Circle 593 on Readers' Service Card

Alva Allen Line of Back-Geared Punch Presses

To meet the need for back-gearred presses adapted for many deep draw and forming operations and many types of punch-press work requiring special feeding, Alva Allen Industries, Clinton, Mo., has designed a complete line of presses ranging in capacity from 2 through 25 tons. These presses give slow, powerful strokes resulting in more advantageous applications of flywheel inertia for many operations and can easily be changed from repeat to nonrepeat

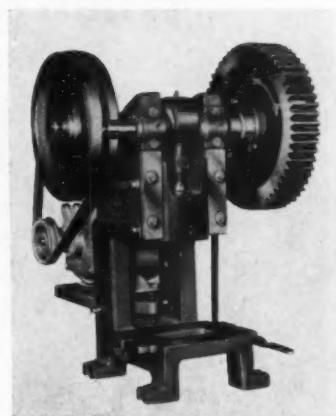


Fig. 1. Alva Allen 2-ton Model B-2-G back-geared punch press

OVERSEAS CAR BUILDER ADDS ANOTHER SNYDER TRANSFER MACHINE IN FURTHER MOVE TO CURTAIL COSTS

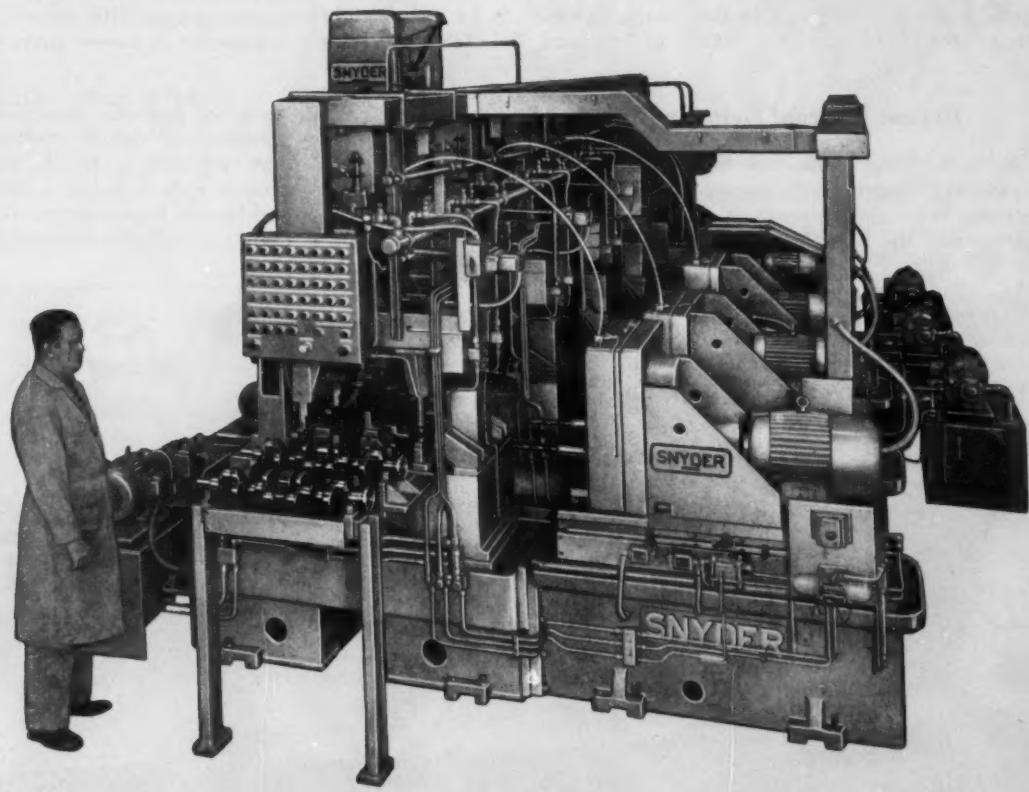
Intensified competition for world markets brought back this old friend of Snyder products seeking further relief from manufacturing cost and labor problems. The answer to this specific problem is a Snyder Special 20-station, building block transfer machine that drills, reams, taps, chamfers and precision-bores 78 automotive engine crankshafts per hour at 100% efficiency.

The overseas customer for whom the machine was built came to the U. S. and, specifically, to Snyder for this cost-cutting, labor-saving machine because of the availability of definite benefits. These include previous experience of Snyder's ability to successfully adapt high-production, cost-cutting techniques to limited production quotas, long experience exclusively in the special machine tool field, domestic and export, and appreciation of Snyder's fresh and creative approach to any pro-

duction problem. There were also the factors of Snyder's engineering and plant resources, assuring fast action and a delivery schedule probably not possible outside the U. S., and the availability of Snyder's standard units, pre-engineered and widely applicable. These same advantages are available to you. We'd like to hear from you.

SNYDER CORPORATION

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action. On standard, conventional punch presses if speed is reduced, the capacity of the press is also reduced. By using a back-gear type press, strokes per minute or flywheel revolutions per minute can be reduced as desired without sacrificing loss of press tonnage capacity.

These new presses, made in six standard models are designed along the same rugged lines as the Alva Allen standard, conventional presses. Other special models with special die space, etc., are available upon request. The 2-ton Model B-2-G, Fig. 1, has a shut height of 5 inches and throat depth of 3 1/4 inches. The standard operating speed is 100 strokes per minute. Standard stroke length is 3/4 inch, and maximum stroke length, 1 1/2 inches. The die-bed area, right to left, is 8 inches, and front to back, 6 1/4 inches. Shipping weight, less the motor, is 150 pounds.

The 3-ton Model BD3-G deep-throat press (not shown) has a shut height of 5 3/4 inches and a throat depth of 12 inches. Like the other presses in this line, the

standard operating speed is 100 strokes per minute. Its weight is 355 pounds.

The 5-ton Model BT5-G, with a shut height of 7 inches, throat depth of 4 inches, and weight of 365 pounds, is also available. The die bed area, right to left, is 10 inches, and front to back, 6 1/2 inches. Maximum stroke length is 2 inches.

The Model B18-G 8-ton press (not shown) has a shut height of 7 inches and a throat of 5 inches. As in all the other presses in this line, the standard operating speed of 100 strokes per minute can be varied by using different-size motor pulleys. The standard stroke length of this press is 1 1/2 inches, and the maximum stroke length, 3 inches. Die-bed area, right to left, is 12 inches, and front to back, 7 inches. This model weighs 570 pounds.

The shut height, throat, standard operating speed, and maximum stroke length of the 12-ton Model BT12-G press are the same as for the 8-ton press. The die-bed area, however, is 14 inches, right to left, and 7 1/2 inches, from

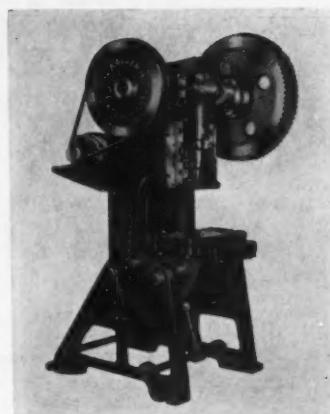


Fig. 2. Model BT25-G Alva Allen back-gear punch press

front to back. This press weighs 1175 pounds.

The 25-ton Model BT25-G press, Fig. 2, has a shut height of 7 3/8 inches and throat of 8 inches. Standard stroke length is 2 1/2 inches, and maximum stroke length, 4 inches. Die-bed area, right to left, is 21 inches, and front to back, 12 inches. The press, less motor, weighs 3400 pounds.

Circle 594 on Readers' Service Card

Bryant Internal Grinder Built for Long Work

An extra long model of the Bryant 1416 internal grinder was recently built and shipped to a customer by the Bryant Chucking

Grinder Co., Springfield, Vt. This machine, Fig. 1, is 4 feet longer than the standard model and will be used to grind the bores and

faces in precision machine tool spindles and similar work-pieces. The work-piece, which can be seen in Figs. 1 and 2, is reversed end-for-end between operations to permit grinding concentric bores

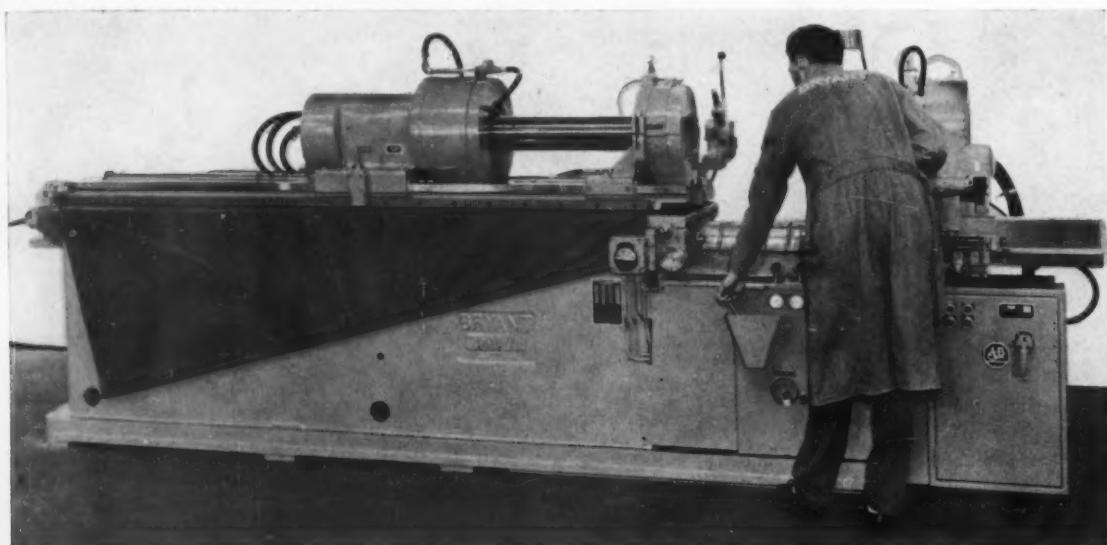
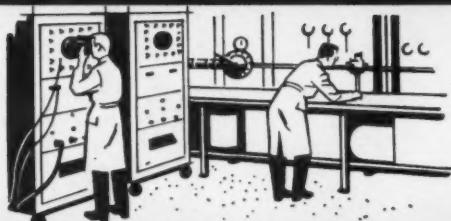
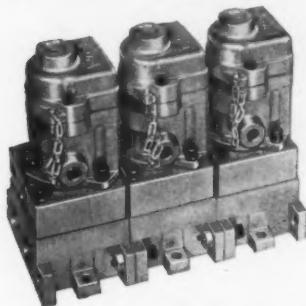


Fig. 1. Bryant extra long internal grinder for precision boring and facing precision machine tool spindles



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4 fine valves from the **Ross** valve line



Fast valves manifolded

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For greater press safety

The Non-Tie-Down valve is designed to protect the press operator's hands. Requires the operator to activate two separate valves continuously during a machine's cycle.



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in both ends. Work-piece specifications require that the 8-inch deep holes in each end be held within 0.0002 inch for size, straight within 0.0001 inch, and round within 0.000040 inch.

Work-pieces are driven by a six-jaw chuck at the work-head end of the machine and are supported at the front end by a steadyrest. Both steadyrest and the 1416-Y work-head are supported on, and positioned as desired, on two parallel ground ways. A third parallel way is furnished to facilitate mounting gaging equipment during work-piece setup and the end-for-end reversing of work-pieces.

The Bryant 1416-Y swings parts up to 16 inches in diameter with holes up to 9 inches deep in this application. Tapers up to 30 degrees included angle can also be ground. In applications where extra long work-pieces are ground, a work-head spindle can be supplied with a 6 1/4-inch diameter bore permitting work-pieces to extend through the chuck toward the rear of the machine.

Circle 595 on Readers' Service Card

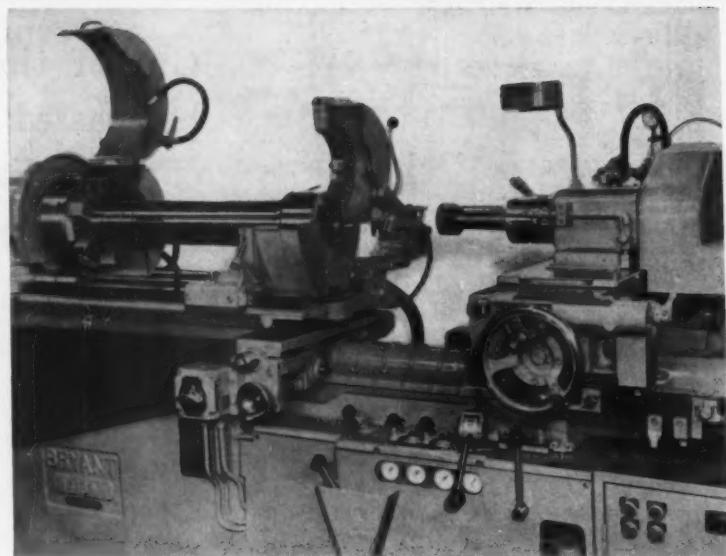


Fig. 2. Close-up view of precision grinding setup on extra long Bryant 1416 internal grinder

Ex-Cell-O Machine Turns Elliptical and Cylindrical Forms Simultaneously

A simple but ingenious method for turning aluminum piston skirts to an elliptical form, while at the

same time turning the ring lands to a true cylindrical form of given diameter, is employed on the machine shown in Fig. 1. This single-end Model 751 precision boring machine built by the Ex-Cell-O Corporation, Detroit, Mich., has two spindles and uses special drum cams and tooling.

Each cam, precision-ground to the elliptical form of the work-piece, is mounted integral with each work-holding fixture on the two Ex-Cell-O spindles. Tools at each work station are held in two independently pivoted and hydraulically controlled tool-blocks mounted side by side. The left tool-blocks nearest the cams, designed to machine the elliptical skirts, are spring-loaded and each is provided with a cam follower.

In operation two pistons are manually loaded and pneumatically clamped. The machining cycle commences as the tool-blocks pivot hydraulically toward the work-pieces, the machine table being in the start position close to the spindles. The cam followers contact the cams, and the ring land cutting tools feed to depth. As the table feeds to the right, the cam-controlled tools turn the elliptical skirt while the

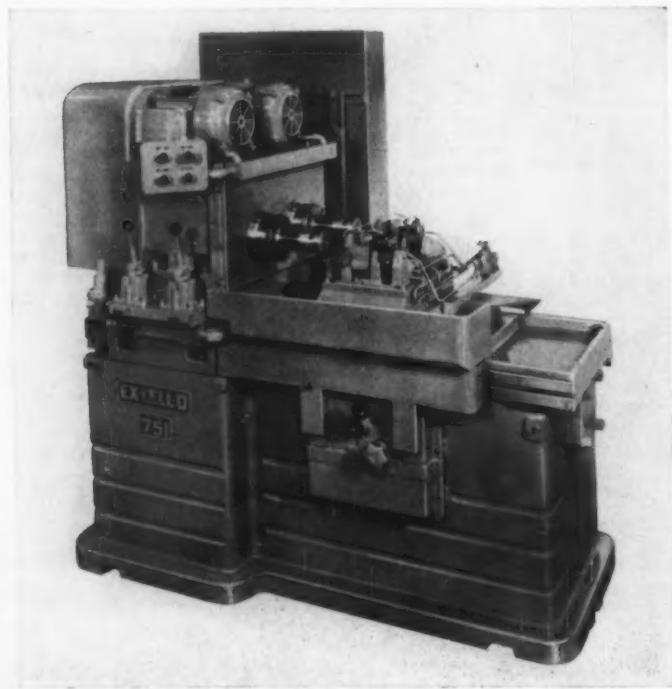


Fig. 1. Machine equipped to turn elliptical form and true cylindrical form simultaneously

Sub Surface to Outer Space



Under or on the surface of the earth, in the air or in outer space, screw threads are vital to man's ability to live, move or work. Strip his inventions of screw threads and he would return to a village handicraft existence. Yes, it would be hard to overstate the im-

tance of screw threads in our modern world, and equally hard to imagine generating internal screw threads efficiently without taps. If you use either standard or specially designed taps for products on which men's very lives depend, can you afford to use any but the best?

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We'd also like to prove to you what our completely integrated manufacturing facilities* can mean to you in terms of lower costs, faster delivery, and complete satisfaction.

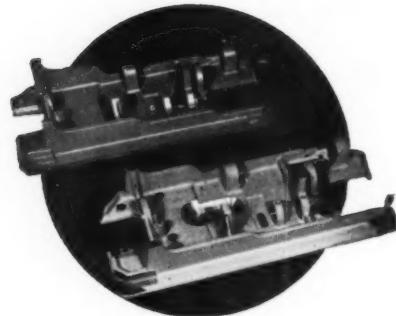
TMW's facilities and 65 years' experience in high-precision (tolerances to tenths) manufacturing are available to you now, on a short or long-term basis. For details or a new Facilities File Folder, call or write today.

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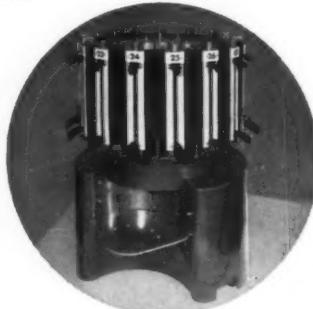
Includes 1,000,000 sq. ft. of manufacturing space, 1200 modern machine tools, completely mechanized foundry (one of the world's largest), 3000 skilled craftsmen with a corps of top designers and engineers.



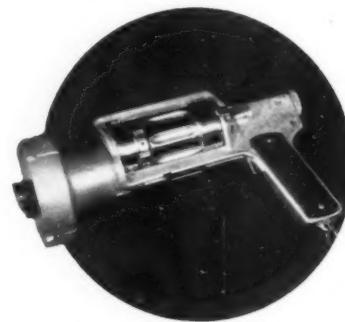
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A TMW gray iron casting before and after precise machining, annealing and finishing operations were performed.



Paint dispenser was economically mass produced for a major manufacturer in TMW's modern shops.



"The world's first and only automatic stud fastener" . . . (another example of TMW precision machining and assembly) carries a LIFETIME guarantee.



Jato units, used on the "Honest John" rocket to make it spin, are machined to $\pm .0002"$ tolerances and hydrostatically tested to meet strict government specifications.



SINGER Numerical Control eliminates layout of the piece, center punching and positioning by hand. Information can be typed out and checked before the part is even available for machining, eliminating all lead time. The SINGER unit provides accuracies of $\pm .001$ on a work table with 40" or more of motion, and up to $\pm .0002$ where closer tolerances are required.

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AT AS LITTLE AS $\frac{1}{6}$ THE COST OF A CONVENTIONAL SYSTEM

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rigidly mounted tools turn the ring land diameter. At the end of the stroke, the tool-blocks pivot away from the work and the table rapid-traverses to the left, or start, position.

A fine mirror finish is obtained. Tolerances on ring-land diameter are held within 0.001 inch and within 0.0003 inch on the elliptical form. Production is 108 parts per hour.

Circle 596 on Readers' Service Card

Portable Magnetic Flaw-Detecting Device

A portable magnet device for detecting cracks and flaws in ferrous metals is being marketed nationally by the X-Ray Department, Westinghouse Electric Corporation, Baltimore, Md. Under an agreement between Westinghouse and the United States Casting Repair Co., developers of the device, called Seal-Lock magnetic crack detectors, this equipment will supplement a number of radiographic and fluoroscopic systems marketed by the Westinghouse X-Ray Department for use in nondestructive materials testing. Designed originally to meet U. S. Casting Repair Co.'s need for an alternating- and/or direct-current unit portable enough for use in the field, the 14-pound crack detector is essentially a powerful U-shaped, two-pole electromagnet which can be energized from a 6- or 12-volt

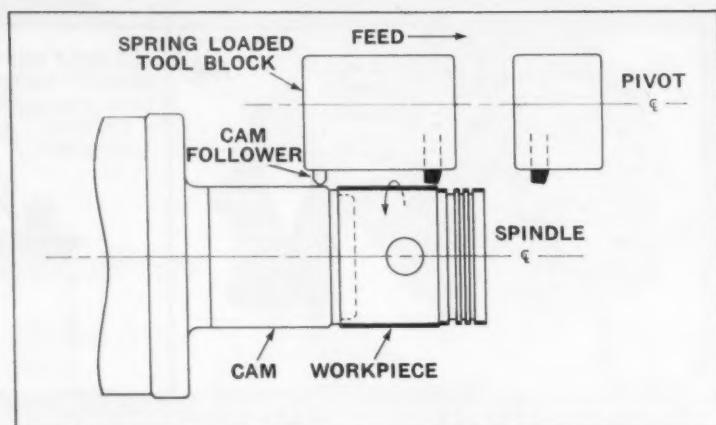


Fig. 2. Diagram showing cam, cam follower, work-piece, and tools of Ex-Cell-O machine (Fig. 1)

automobile storage battery or from a 110-volt service outlet through a built-in rectifier.

In use, the detector is placed so that the two poles bridge the area to be examined. When power is switched on, this causes lines of nonreversing magnetic flux to flow through the specimen. To make this flux pattern visible, a surface coating of ferromagnetic powder is sprinkled over the 72-square-inch area that can be covered in one test. Since any discontinuities in the metal specimen distort the steady-state magnetic field, the particles align themselves in a pattern duplicating the outlines of any flaws that are present.

Circle 597 on Readers' Service Card

Lincoln Arc Welder

Lincoln Electric Co., Cleveland, Ohio, has developed a 225-ampere, alternating-current transformer type arc welder offering metal-working shops output capacity and variety of electrode selection formerly available only in larger, higher-priced industrial models. The new model is designed to fill the need for welder performance between that of high-capacity production welding equipment and small 180-ampere shop machines. The 225-ampere welders will equip the user to perform "big" jobs, thus eliminating the need for outside welding assistance.

Circle 598 on Readers' Service Card



Flaw-detecting equipment announced by the Westinghouse Electric Corporation



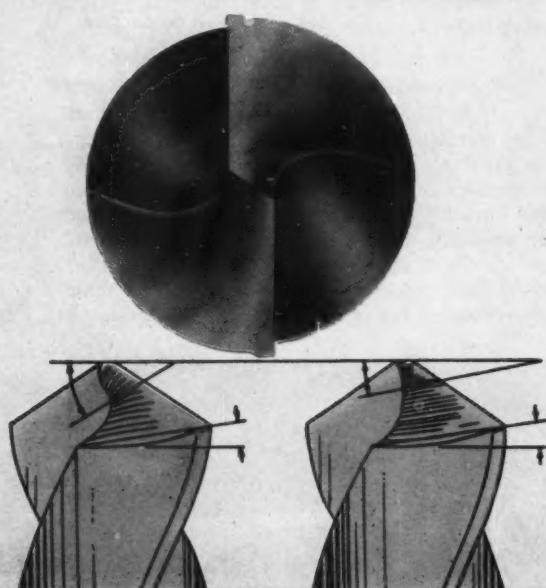
Transformer type, 225-ampere arc welder announced by Lincoln Electric Co.

NEW FOR 1961

OLIVER OF ADRIAN MODEL 600 DRILL POINTER

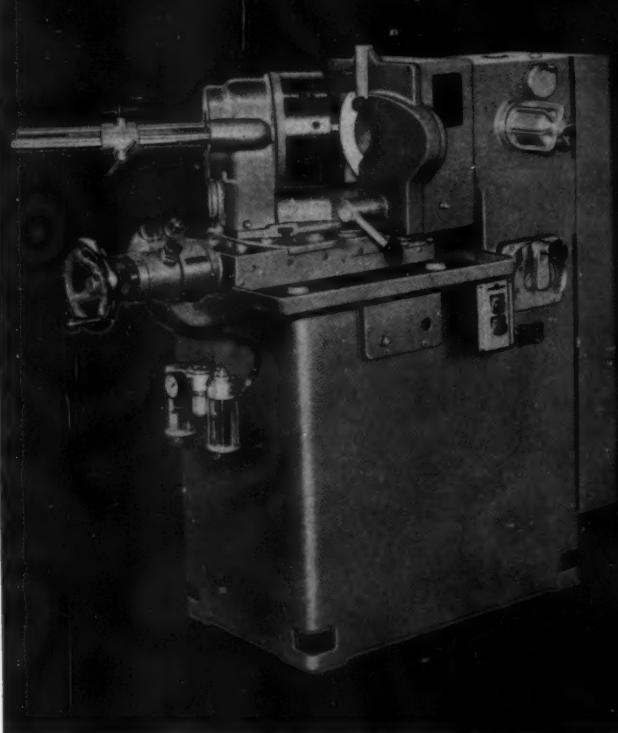
For 40 years, the theoretically perfect *Oliver Drill Point* has been an industry favorite. Oliver's new drill pointer has been completely redesigned—offers more advantages than ever before! Retaining the thoroughly proven point, the machine has the ability to stand up even longer under rigorous day-after-day service.

The three versions of the "600" have a capacity of $\frac{1}{2}$ " to 3". One is for dry grinding, one for wet grinding, and one is a combination wet grinder with an "airdraulic" automatic infeed for larger drills. Wet grinders are particularly important for drills requiring extensive stock removal. The airdraulic infeed makes the machine 100% automatic after set up (can be operated manually if desired).



Easier Penetration

The proven *Oliver Drill Point* is known for providing more holes per grind. Less torque—less thrust is needed for penetration. Lower feeding pressure saves on drilling machine repairs, power costs and drills. The *Oliver Drill Point* is ground to increase clearance as the center of the drill is approached. Each lip does its equal share. The drawing at the right shows a conventional drill point with constant clearance. The one at the left is an exaggerated view of the Oliver point. You can see that the clearance angle increases rapidly as the drill web is approached.



Machine Provides Complete Accuracy

New features of the Oliver Model 600 Drill Pointer are built around the demands for accuracy and trouble-free operation.

- A new scroll-type chuck is incorporated. Moving parts are sealed against foreign material and a recirculating lubrication system and anti-friction bearings assure long life. A dual support center rest assembly provides greater accuracy.
- Variable clearance—approximately six times greater than ever before—is supplied with a new hand wheel control.
- Direct drive to the chuck—no universal joint.
- Grinds two-, three- or four-flute drills.
- All components are larger and heavier. Controls are in front for simple operation.

Oliver also provides bench model machines for sizes $\frac{1}{2}$ " and smaller. A cam-controlled, heavy-duty model grinds the *Oliver Drill Point*. A standard machine is also available for the conventional point.

Yes, the Oliver of Adrian Drill Pointer is bigger and better than ever. Oliver will sharpen your drills on a "no charge" trial basis. Write for full information—satisfy yourself—then give us an opportunity to quote.

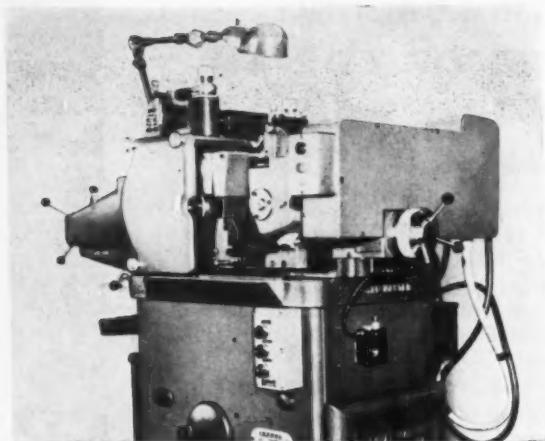
OLIVER of ADRIAN
1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS AUTOMATIC AND MANUAL
FACE MILL GRINDERS TOOL AND CUTTER GRINDERS TOOL
BIT GRINDERS CONTOUR GRINDING AND FINISHING MACHINES

Precision Centerless Grinder

Royal Master Grinders, Inc., Riverdale, N. J., has recently added to its line a high-precision centerless grinder, Model CG-12-A. This machine features high-speed, automatic cycling with positive repeating action, and can also be operated manually. For safety, it can be returned to the "open" position at any stage of the grinding operation by pressing a button. It can grind multiple-diameter parts and balls out of stainless or carbon steel, as well as glass and plastic materials. It also grinds wood, nonferrous metals, fiber, hard rubber, ceramics, and cork.

Special characteristics of this 30- by 54-inch grinder include: high output and fast checking with both sides of the wheel accessible from operation position; work performed with accuracy and dependability; coolant tank



Royal Master high-precision centerless grinder

mounted on casters for mobility; massive heat-treated alloy spindle with ball bearings lubricated for life; wheel dressers which can be either manually or hydraulically operated; mounted wheel which is easily lifted by one man; a regu-

lating wheel spindle mounted between ball bearings to prevent deflection; and a permanently mounted crush type wheel dressing unit.

Circle 599 on Readers' Service Card

Cross Trunnion Machine for Processing Work-Pieces of Different Materials

To meet production requirements for work-pieces of different designs and materials, The Cross Company, Detroit, Mich., has introduced new operating features in its trunnion machines. These automatic machines handle fami-

lies of parts, perform a greater variety of operations, provide greater accuracy, and give higher production than preceding models.

A typical application of the new-design trunnion type machine is in the manufacture of remote-

accessory cylinders for tractors. Cylinders, which differ in both size and material, are rough-, semifinish-, and finish-bored, and faced, on the machine shown in Fig. 1. Drilling, counterboring, chamfering, tapping, and grooving operations are also done in this ten-station machine. Two main heads and four auxiliary heads

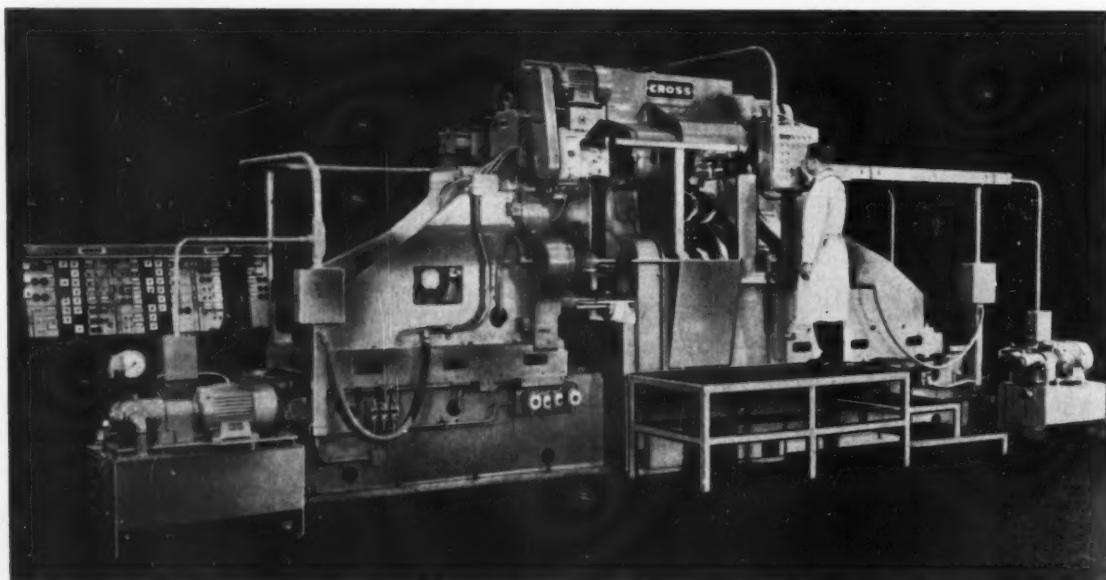


Fig. 1. Cross machine finishes hydraulic cylinders of two different lengths and two different metals

ANACONDA FREE-CUTTING BRASS

Free-Cutting... Cost-Cutting

Year after year after year, engineers who know brass select Anaconda Leaded Brasses for their special characteristics and qualities.

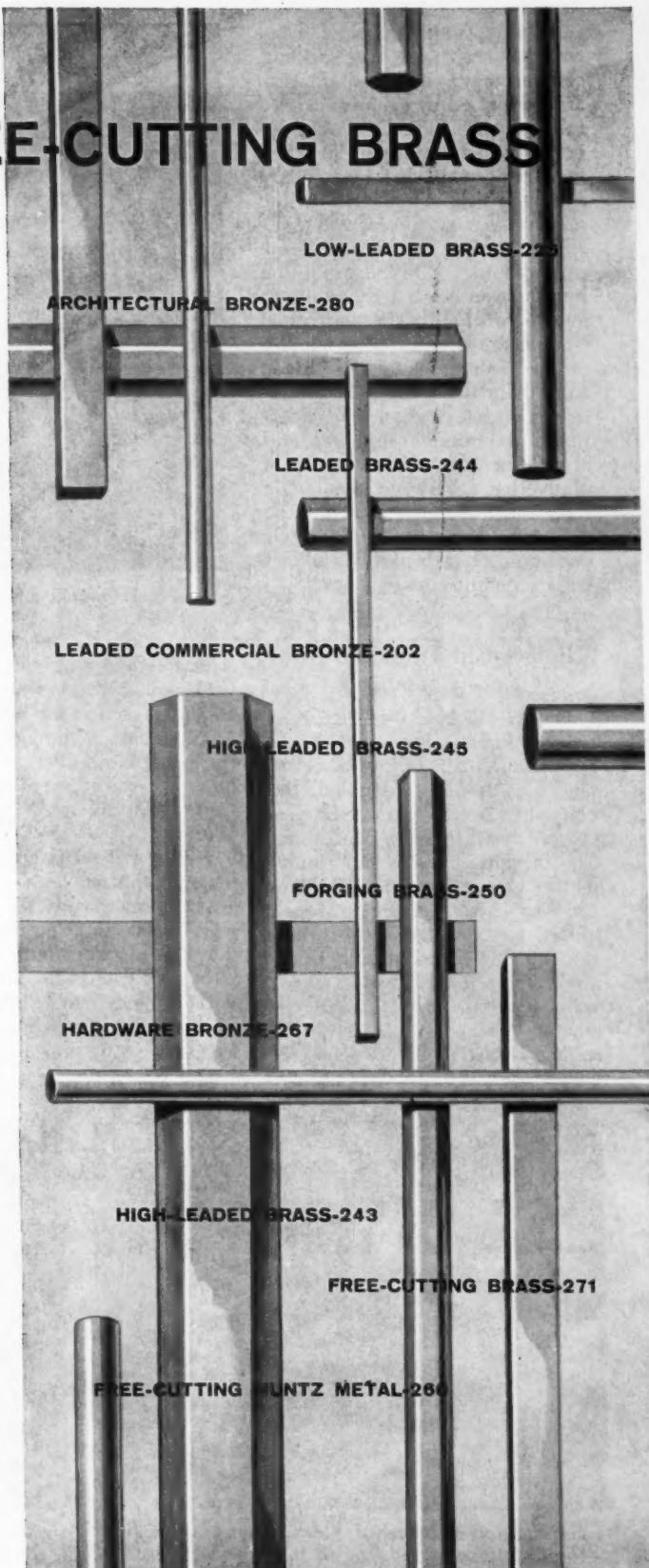
The superior machining qualities of Anaconda free-cutting brass rod permit the use of heavy feeds and high cutting speeds. Tool life is much longer; tool breakage considerably less. Close tolerances are held for longer continuous runs. What's more, you get fewer rejects, more accurate assemblies, and products with better appearance.

When you buy or specify Anaconda American Brass, you can choose from nearly 300 different alloys . . . the greatest range of sizes, shapes, tempers and characteristics in Copper and Copper Alloys. Contact your Anaconda representative or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-1147

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AMERICAN BRASS COMPANY



carry all cutting tools. Similar operations—such as boring, drilling, counterboring, and chamfering—are performed by spindles carried in the main heads. Dissimilar operations, such as tapping and facing, are accomplished by auxiliary heads, which are related to the main heads in different ways.

The tapping heads, Fig. 2, are carried into the tapping position by the main heads but have their own motors to drive the individual lead-screw spindles. The spindles of the facing heads are driven from the main heads but are positioned on massive guide bars carried in the trunnion supports. This arrangement provides a minimum of overhang between the facing tools and their supports, resulting in maximum accuracy. Facing is done on both ends of the cylinders with generating tools.

High-Speed Tube and Rod Cutoff Machine

H & H Machine Co., Inc., Norristown, Pa., has developed a high-speed, automatic abrasive cutoff machine that has doubled the company's production rate on precision metal-tubing fabrication. The machine handles such tough metal tubing as molybdenum, stainless steel, rodar, Monel, nickel, tungsten, and low-carbon steel quickly and accurately in diameters up to 3/8 inch where walls are thin. As the outside diameter decreases, heavier-walled tubing is also handled economically. Lengths to 2 inches are cut

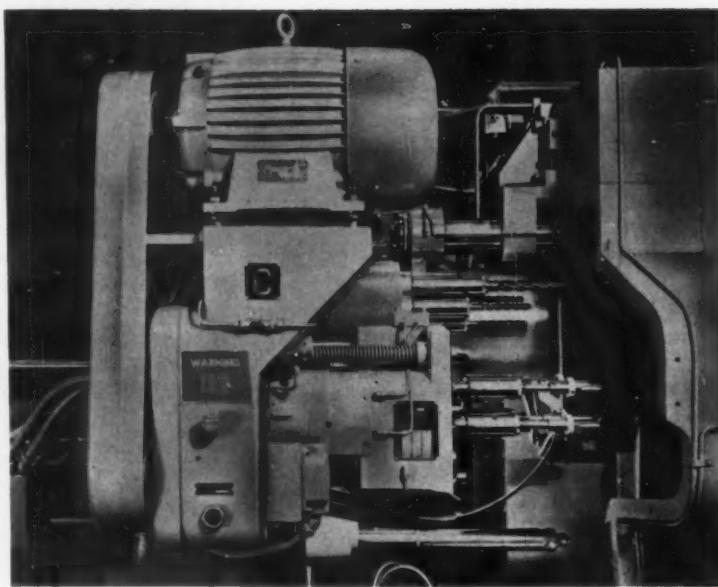


Fig. 2. A tapping head is mounted on each of the main tool-heads of Cross trunnion type machine (Fig. 1)

with tolerances of plus or minus 0.003 inch. Much of the company's tubing is used in the manufacture of electronic components where extremely close tolerances are required. Production rates range from 3,000 to 7,000 pieces per hour.

Tubing or rod is automatically fed into the machine, which adjusts automatically for abrasive wheel wear, shutting down when the wheel is worn out. The operator merely changes wheels and starts or feeds new lengths of material into the machine. Water-soluble oil is used as a coolant.

Circle 600 on Readers' Service Card

Systems for Automatically Duplicating and Verifying Tapes

Friden, Inc., Rochester, N. Y., has announced a complete line of tape comparator systems and additions to its regeneration equipment designed to automatically duplicate and verify tapes and edge cards. This new equipment provides greater ease and reliability in duplicating and comparing five-, six-, seven-, or eight-bit codes for computer and numerical systems. A choice of eight systems

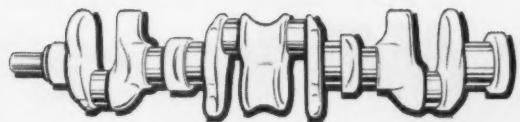
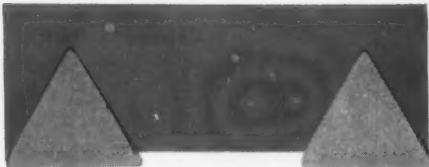
(Continued on page 193)



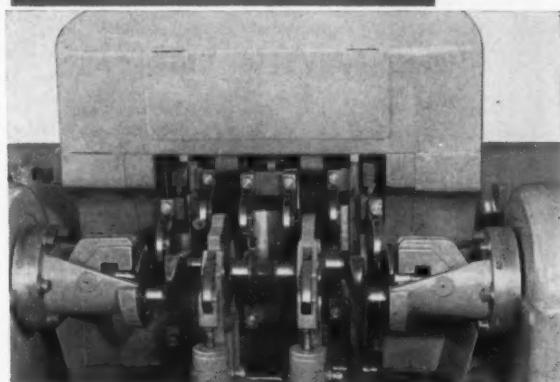
Tube and rod cutoff machine designed for high-speed production developed by H & H Machine Co., Inc.



Friden tape-to-tape regeneration comparator system for duplication of tapes punched by Flexowriter



QUICK-CHANGE VERSATILITY!



Yours since 1955 with **WICKES**
highly versatile MP-4 cartridge-type Crankshaft lathe.

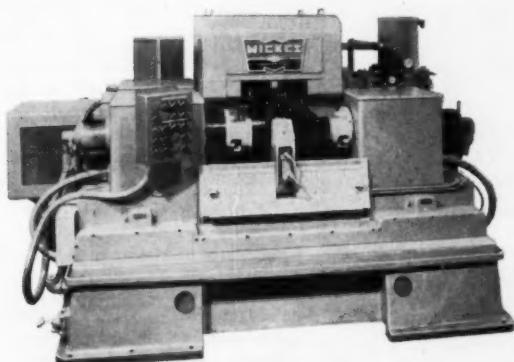
1955 produced a forecast of the future when WICKESmanship developed and introduced the highly adaptable MP-4 Crankpin turning lathe. A true quick-change artist, the MP-4, utilizing a master crankshaft as a template, is designed to turn three different types of crank shafts, turning and checking all crank pins at one time. A quick change of the center section on the MP-4 accommodates different spacing of crank pins, as well as different strokes. Master crankshafts can also be changed quickly to handle crankshafts of identical design but with different strokes. Production efficiency proven in steel . . . and on the job . . . since 1955!

The center section . . . heart of the MP-4 . . . can be changed in 4 hours, master crankshafts changed in 2 hours! These are actual changeover times clocked on the job. Your WICKESman is ready to show you how the versatile MP-4 lathe . . . developed by WICKESmanship in 1955 . . . can truly cut your production time and costs in the 60's. Call him today.



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MP-3 . . . MP-8 . . . and . . . MP-10 models
are also available in this
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Charles O. Herb, Jr.

NEW CATALOGUES



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Bronze Case

Thomson Industries, Inc., Manhasset, N. Y. Catalogue giving a description of a bronze case for guide rods and piston rods. In combination with hardened steel bushings, it is said to increase the life of these working parts tenfold. Specifications are listed.

Circle Item 501 on Inquiry Card



Air Cylinders

Sheffer Corporation, Cincinnati, Ohio. Bulletin No. 161 presenting the firm's improved series of dimensionally interchangeable, 250-psi cushion type air cylinders, in bore sizes of 1 1/8 through 14 inches, with twenty standard mountings.

Circle Item 502 on Inquiry Card



Machine Tools

Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin MT 4 presenting specifications and illustrations of the entire line of B&S machine tools, including milling, grinding, automatic and hand screw machines, and turret drilling machines.

Circle Item 503 on Inquiry Card



Roll Feeds

Ferguson Machine Co., St. Louis, Mo. Catalogue No. 500 on the company's cam-indexed Camtrol roll feeds with infinitely variable stroke. They are said to attain extreme repetitive accuracy of feeding at speeds above 1000 strokes a minute.

Circle Item 504 on Inquiry Card



Cutting Tools

Eclipse Counterbore Co., Detroit, Mich. Catalogue No. C-59 giving a presentation of Eclipse cutting-tool applications. Special and standard tools, radial and pin drives, interchangeable pilots, and inverted spot facers are discussed.

Circle Item 505 on Inquiry Card



Induction-Heating Machine

Meta-Dynamics Division, Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalogue No. M-2143 covering the RF Inductron induction-heating machine for selective hardening, soldering, stress-relieving, tempering, bonding, annealing, and brazing.

Circle Item 506 on Inquiry Card



Hole-Punching Units

Wales Strippit Inc., Akron, N. Y. Catalogue BN on self-contained hole-punching units for up to 3 1/2-inch diameter holes in flanged parts, angles, and sheets. Hints are offered on mounting methods and short cuts using Strippit tooling.

Circle Item 507 on Inquiry Card



Servo Valve

Vickers Incorporated, Detroit, Mich. Bulletin 61-79 on a single-stage servo valve (Series SC4) for electrohydraulic servo systems. It is available with a choice of torque motor resistances compatible with electronic, magnetic, or transistor inputs.

Circle Item 508 on Inquiry Card



Thread-Rolling Machine

Landis Machine Co., Waynesboro, Pa. Bulletin E-104 on the Landis Heavy Duty thread-rolling and forming machine with 200,000-pound pressure and 6-inch diametrical capacity. Bed, in-feed system, Thrufeed rolling, and Lubricoolant system are described.

Circle Item 509 on Inquiry Card



Carbide Tools and Inserts

Sandvik Steel, Inc., Fair Lawn, N. J. Catalogue No. 610 (and price list) on Coromant tungsten-carbide tooling. Featured are new sizes and styles recently added to the line, including T-Max disposable-insert tools and a T-Max profile tool-holder.

Circle Item 510 on Inquiry Card

He's making a Monarch Lathe...



One example of where the extra values come from—in your MONARCH Lathes

This, sir, is the heart of the hydraulic circuitry in a modern Monarch headstock. This is our own *brazed* aluminum manifold and, bluntly, there's nothing else like it. Almost no piping or tubing. No varying pressures or incipient leaks. Just carefully machined flow channels in a core brazed to the two aluminum covers—for permanent undeviating responses. Courtesy of the Monarch Metallurgical Laboratory, exclusively. And component by component, assembly by assembly, you find the same story repeated throughout your Monarch Lathe.

We obviously can't hang the same price tag on this machine that you find on the lighter, stripped-down competition. So what price quality?

Assume someone in your shop picks up a "bargain" 5 H.P., 5000 lb. lathe with capacity of about 7½ cu. in. per minute. After you've discounted your bargain, how will your piece costs compete compared with a 20 H.P., 9600 lb. Monarch throwing 36 cu. in. of chips per minute? Or your down-time? Or your machine life?

Where's the "bargain?" Let us prove that it pays to buy quality. In our shop—on your job. Just write—THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.



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MONARCHS COST LESS

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TURNING MACHINES



VISIT MONARCH—We'll turn your part to return you profit

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Arbor Support Bearings

Briney Mfg. Co., Pontiac, Mich. Bulletin AB 61-2 on the firm's anti-friction arbor support bearings. Replacement and maintenance cost saving, greater work area, elimination of cutter chatter, and increase of machine feeds and speeds are discussed.

Circle Item 511 on Inquiry Card



Power Presses

Dechert Dynamics Corporation, Palmyra, Pa. Catalogue describing Zeh and Hahnemann and Robinson industrial presses. Arch, horn, screw, toggle, drawing, punching, reducing, open-back, reclinable, double-crank, and other presses are included.

Circle Item 512 on Inquiry Card



Metal Cleaning

Turco Products, Inc., Wilmington, Calif. Brochure containing specific information for the use of each of the forty-three products that make up the company's standard line of cleaning and processing compounds for the metalworking industry.

Circle Item 513 on Inquiry Card



Die-Casting Machine

Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin No. 461 giving specifications and construction features of the Model 400 high-pressure hydraulic die-casting machine, available either as a "hot chamber" or "cold chamber" machine.

Circle Item 514 on Inquiry Card



Heavy-Duty Lathe

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Bulletin HD-461 featuring information on LeBlond's 4025 NK heavy-duty lathe, available in both manual, and Servo-Shift models. It has been redesigned with new headstock, tailstock, and carriage.

Circle Item 515 on Inquiry Card



"Unitized" Tooling

Tool Products Corporation, North Tonawanda, N. Y. Catalogue describing the firm's line of "Unitized" tooling for the metal-fabricating industry. Regular-duty round-hole, regular-duty shaped-hole, and heavy-duty round-hole units are covered.

Circle Item 516 on Inquiry Card



Boring Machines

Ex-Cell-O Corporation, Detroit, Mich. Bulletin G1A showing, in condensed form, a complete line of standard precision boring machines, which are used for roughing and semifinishing work, as well as for the most precise finishing operations.

Circle Item 517 on Inquiry Card



Cast Alloy

Vascoloy-Ramet Corporation, Waukegan, Ill. Booklet No. 6102 featuring the applications for V-R Tantung, a cast alloy for cutting-tool and wear applications. A complete surface-speed table and tool selector chart is included.

Circle Item 518 on Inquiry Card



Surface Grinder

Landis Tool Co., Waynesboro, Pa. Catalogue 618H-61 on the 618 hydraulic precision surface grinder with hardened rollers for table and saddle, and individual hydraulic motors for power cross-feed, traverse, and elevation to the wheel-head.

Circle Item 519 on Inquiry Card



Jig Borer and Grinder

Moore Special Tool Co., Inc., Bridgeport, Conn. Circular on "Package of Precision," the company's No. 3 jig borer, jig grinder, measuring machine, and 2-second rotary table. An illustrated example shows work performed on a master index-plate.

Circle Item 520 on Inquiry Card



Saws

LeTarte Co., Inc., East Detroit, Mich. Brochure on three standard models of the company's Double Mitre saw, which has a 39-inch working height, recessed knee control, is constructed to receive its own scrap, and has an adjustable saw blade.

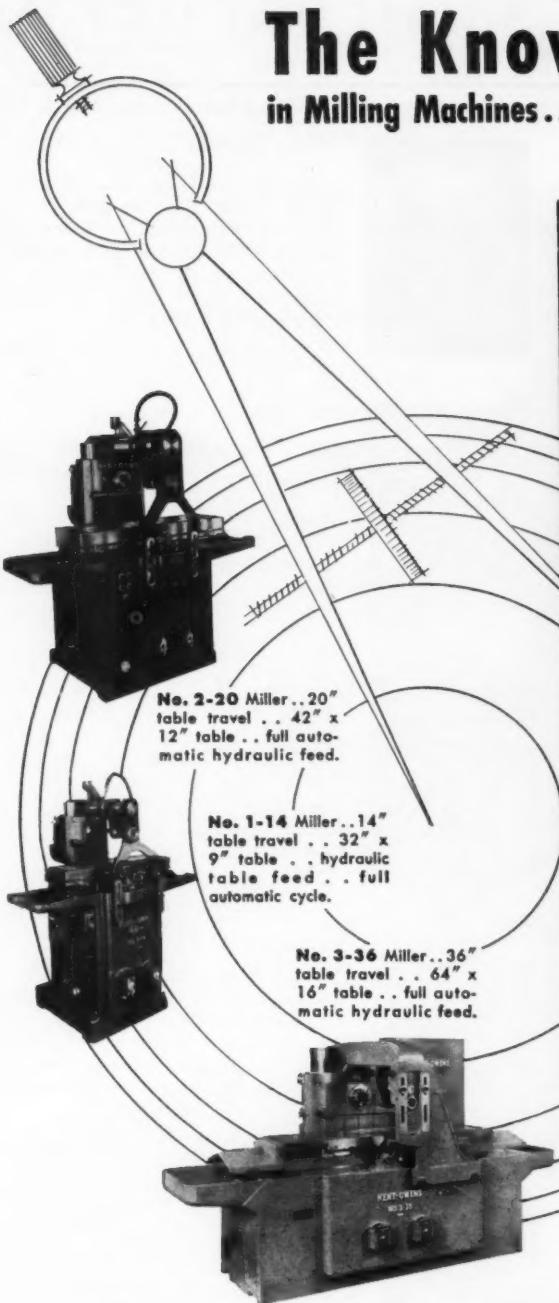
Circle Item 521 on Inquiry Card



Milling Machines

Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin MM 55 presenting construction features, operations, and optional equipment, for Dynamaster No. 2 universal milling machines, available with 3-, 5-, 7 1/2-, or dual 10/5-hp spindle drive motors.

Circle Item 522 on Inquiry Card



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in Milling Machines . . Special Machinery . . Automation Equipment



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Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for answers to their production problems.

When you are considering procurement of machinery for your milling needs . . or seeking the solution to

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Write or call . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

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Gears

Perkins Machine & Gear Co., West Springfield, Mass. Catalogue covering the firm's line of "custom-cut" metallic and nonmetallic gears, used in aircraft parts, household appliances, portable and machine tools, and precision instruments.

Circle Item 523 on Inquiry Card



Air Motors and Cylinders

Lehigh Inc., Easton, Pa. Brochure presenting information on the company's heavy-duty air motors, self-lubricating air cylinders, and Le-Hy Checktrol—a hydraulic unit for use wherever precision control of air-powered devices is needed.

Circle Item 524 on Inquiry Card



Coolant-Cleaning Equipment

Barnes Drill Co., Rockford, Ill. Bulletin No. 100-A describing Kleenall fabric filters and combination magnetic and fabric filters for honing, grinding, milling, drilling, superfinishing, and other operations requiring clean coolant. Advantages are covered.

Circle Item 525 on Inquiry Card



Numerical Positioning Controls

Rheem Electronics, a division of Rheem Mfg. Co., Los Angeles, Calif. Brochure on the company's M-44 numerical positioning controls for precision boring-machine application. The Ex-Cell-O Model 758 Numera-Trol machine is described.

Circle Item 526 on Inquiry Card



Profilometer

Micrometrical Mfg. Co., Ann Arbor, Mich. Brochure presenting practical features and applications of the firm's Profilometer, which is a direct-reading shop instrument that measures average roughness in root-mean-square or arithmetical units.

Circle Item 527 on Inquiry Card



Flat Finishers

Hammond Machinery Builders, Inc., Kalamazoo, Mich. Catalogue No. FF-755 covering Hammond's line of abrasive-belt flat finishers, which are presently being offered with up to six heads for work up to 12 inches. Various models are described.

Circle Item 528 on Inquiry Card



Milling Machine

AutomaticMILL, Inc., Danbury, Conn. Brochure giving data on the firm's AutomaticMILL for automating milling work. Included is a summary description of the machine, data on operation, specifications, production rates, holding fixtures, etc.

Circle Item 529 on Inquiry Card



Plug Gages

Deltronic, Costa Mesa, Calif. Catalogue featuring information on the firm's tenth plug gages. Nine-gage sets; 25-gage sets; "Half-Thou-Sets," drill-size, and 0.001 step sets; and setting standards sets are described. Gaging short cuts are given.

Circle Item 530 on Inquiry Card



Forgings

A. Finkl & Sons Co., Chicago, Ill. Bulletin 400 giving a description of the company's die-blocks, forgings, and hot-work and electric furnace steels. Finkl's flexible melt shop, forging equipment, machine shop, and heat-treat department are covered.

Circle Item 531 on Inquiry Card



Stock Reel and Bar Feeder

National Acme Co., Cleveland, Ohio. Bulletin MFR-61 on how the combination magazine-fed stock reel and Acro bar-feeder attachment eliminates loading down time and provides extra-long feed-out, which extends Acme-Gridley bar machine capability.

Circle Item 532 on Inquiry Card



Hose Fittings

Aeroquip Corporation, Jackson, Mich. Bulletin containing data on Aeroquip 1509 multiple-wire braid hose and "Iron Mike" fittings. Specifications for straight, elbow, and split-flange fittings are given. Assembly instructions are included.

Circle Item 533 on Inquiry Card



Business-Building Kit

Metco Inc., Westbury, N. Y. Circular covering a job-shop business-building kit showing how to profit from low-cost sales promotion and offering the material needed to help build the customer's volume of profitable metalizing business.

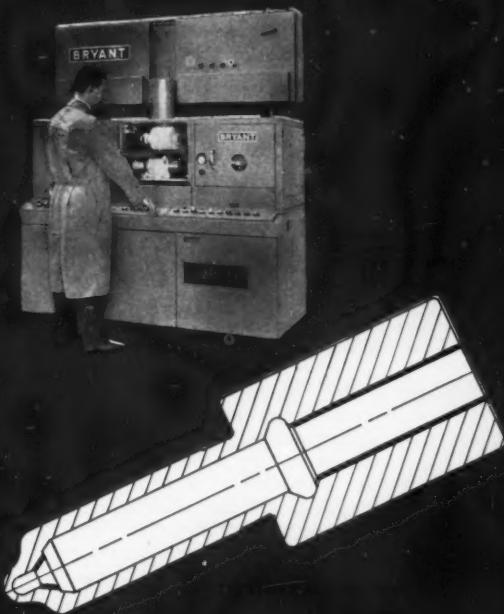
Circle Item 534 on Inquiry Card



CAN YOU TOP THESE 2 GRINDING JOBS?

They're tough. One requires grinding both a straight and a tapered bore in diesel nozzles and similar workpieces at a single chucking. The second requires grinding a wide range of races for miniature and instrument ball bearings. Both are handled efficiently and economically by Bryant high production internal grinders.

All Bryant industry-engineered grinders are proved out by statistical quality control to assure you of predictable day-after-day production quality. Got a tough internal grinding job? Just drop us a line, enclosing specs and production requirements.



SOLUTION to the diesel nozzle job is this new Bryant Double-End Internal Grinder which grinds both a straight and a tapered bore at a single chucking of the workpiece. Two opposed wheel slides and a rotary indexing worktable permit grinding two workpieces simultaneously. Completely automatic, it triples the productivity of conventional machines. And, because this duplex machine cycles automatically, operator simply has to load and unload workparts.



SOLUTION to the grinding of a wide range of miniature and instrument bearing races is the Bryant Model "B" Miniature Cen-align® Internal Grinder and its "packaged tooling" for simple, quick job changeover. Available either for ball tracks or for bores, it's the standard machine for miniature bearing production throughout the world. Proved in production lines, it's acknowledged by all major bearing companies as the finest machine available.

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Cutting Fluid

Cincinnati Milling Machine Co., Cincinnati, Ohio. Brochure PC-375 providing data on the "Five-Star" Cimcool chemical-emulsion, water-base cutting fluid, which gives trouble-free performance. It has extremely effective rancidity and rust control.

Circle Item 535 on Inquiry Card



OBI Presses

Federal-Warco Division, Federal Machine & Welder Co., Warren, Ohio. Bulletin No. 52113 covering the Warco line of open-back inclinable presses, in capacities from 40 to 200 tons. Frame, slide bearings, crankshaft, etc., are described.

Circle Item 541 on Inquiry Card



Metalworking Machinery

Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin 90-6 introducing more than 3800 types and models of metalworking and material-handling equipment. Press brakes, punches, shears, bending rolls, threaders, saws, etc., are described.

Circle Item 536 on Inquiry Card



Differentials and Gears

Instru-Lec Corporation, Mount Vernon, N. Y. Folder containing engineering information on precision differentials and end gears. Keyed drawings and tables are included for solid- and hollow-shaft differentials, in wide and narrow design.

Circle Item 542 on Inquiry Card



Drive Tensioner

Maurey Mfg. Corporation, Chicago, Ill. Catalogue TR-1 describing three Hi-Q drive tensioners, effective on all types of drives. The idler arm can be moved to any desired angle for the right tensioning position of the idler pulley.

Circle Item 537 on Inquiry Card



Welding Pressure Pipelines

Lincoln Electric Co., Cleveland, Ohio. Bulletin 2112.2 giving information on techniques and costs related to cross-country transmission and pressure piping systems. API pipe specifications, analysis, and physical properties are reviewed.

Circle Item 543 on Inquiry Card



Carbide Tooling

Arthur A. Crafts Co., Inc., Boston, Mass. Folder (Form No. 161B) providing details on carbide tooling for automatics. Circular form tools; flat, dovetail, and skiving tools; cut off tools; and end-cutting tools are among those discussed.

Circle Item 538 on Inquiry Card



Metalizing

Metco Inc., Westbury, N. Y. Bulletin containing nine separate stories of cases where products were salvaged or improved with modern metalizing. Examples that are given cover flame spraying with metals in both wire and powder form.

Circle Item 544 on Inquiry Card



Flexible Couplings

Dodge Mfg. Corporation, Mishawaka, Ind. Bulletin 901B giving data on the firm's expanded line of Para-flex flexible cushion couplings that absorb vibration and compensate for all combinations of shaft misalignment and end float.

Circle Item 539 on Inquiry Card



Centerless Turning Machine

Taber Instrument Corporation, North Tonawanda, N. Y. Bulletin (specification sheet and price list) covering details on the company's Model 902-1 Trace-O-Matic centerless shaft-turning machine. Optional equipment and supplies are itemized.

Circle Item 545 on Inquiry Card



Presses, Brakes, and Shears

Pacific Industrial Mfg. Co., Oakland, Calif. Catalogue No. 302 giving a description of Pacific's hydraulic presses, brakes, and shears for bending, punching, drawing, rolling, braking, corrugating, blanking, and straightening operations.

Circle Item 540 on Inquiry Card



Drill Pointer

Winslow Product Engineering Corporation, Arcadia, Calif. Brochure on the Model 1000 Winslo-Matic drill pointer. Push-button control, drill and hopper capacity, production rate, point configuration, point angle, etc., are discussed.

Circle Item 546 on Inquiry Card

USES NEW 2-in. WIDE



TUNGSTEN CARBIDE

and



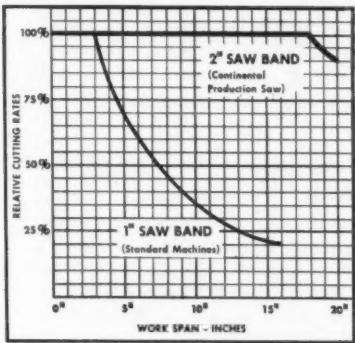
HSS SAW BANDS

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DoALL
PRODUCTIVITY-
PLUS
product



new
Continental
Production Saw
changes
economics of
cutoff sawing

... outperforms any other band saw on a cost-per-cut basis on work up to 16" x 20" section



The development of 2-in. wide saw bands simultaneously with the new Continental Production Saw has completely revolutionized the economics of cutoff sawing. The 2-in. saw bands have four times the beam strength of 1-in. band.

The resulting increase in band rigidity to permit heavy feeds provides cutting rates up to 30 sq. in. per min. in mild steel. New accuracy standards also result from this 2-in. blade and machine combination.

Machine Features

- Overhead vises provide unobstructed work area
- Automatic chip disposal
- Hydromechanical drive (no belts)
- Fast automatic index with micrometer adjustments (to $3\frac{1}{2}$ " stub ends)
- Automatic feed control for most efficient cutting rate in varying work sections
- Recirculating coolant system

You can see the Continental Production Saw work in a sound color movie right in your office—or better yet, see it demonstrated in the DoALL Hall of Progress in Des Plaines. Call DoALL today.

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Thread-Grinding Machine

Jones & Lamson Machine Co., Springfield, Vt. Folder describing a precision thread grinder, which has, among other features, a capacity for up to 4-inch diameter work with 10 inches of full thread length and a variable-speed work-spindle.

Circle Item 547 on Inquiry Card



Crankshaft Lathes

Wickes Machine Tool Division, Wickes Corporation, Saginaw, Mich. Brochure 261 presenting a line of crankshaft lathes. Among the models included are center-drive crankshaft, single- and double-spindle crankpin, and double end drive types.

Circle Item 553 on Inquiry Card



Injection Molding Machines

Farrel-Birmingham Co., Inc., Watson-Stillman Press Division, Rochester, N. Y. Bulletin 601 describing 12- to 20-ounce screw and plunger type plastics injection molding machines. Design features, both standard and optional, are discussed.

Circle Item 548 on Inquiry Card



Salt Baths

A. F. Holden Co., Detroit, Mich. Bulletin 200 on salt baths and chemicals. Covered is a wide range of applications, including neutral hardening, tempering, austempering-martempering, carburizing, annealing, high-speed quenching, and nitriding.

Circle Item 554 on Inquiry Card



Turret Toolposts

Farrel-Birmingham Co., Inc., Watson-Stillman Press Division, Rochester, N. Y. Catalogue TTP-611 presenting the company's precision automatic turret toolposts. Wear and bearing surfaces are casehardened to 60-62 Rockwell C, and contact faces of the base and tool-block are ground and lapped.

Circle Item 549 on Inquiry Card



Couplings

Lovell Flexible Couplings, division of Lovell Mfg. Co., Erie, Pa. Circular on flexible couplings designed around the physical characteristics of Lovellex, a practically indestructible material. Included are Farrel-Birmingham Gearflex couplings.

Circle Item 555 on Inquiry Card



Adjusting Tools

Briney Mfg. Co., Pontiac, Mich. Catalogue 61-C containing details on three types of adjusting tools, which allow precision adjustments in tenths without loosening or tightening any screws. All three types are assembled with preloaded ball bearings.

Circle Item 550 on Inquiry Card



Numerical Control

Friden, Inc., Rochester, N. Y. Booklet presenting educational data about the growing machine tool numerical-control field. The use of punched tape in machine tool applications and the Flexowriter automatic writing machine are covered.

Circle Item 556 on Inquiry Card



"Tailored" Tooling

Kennametal Inc., Latrobe, Pa. Bulletin B-600 showing how to use a new line of KENDEX standardized adjustable units with throw-away inserts in multiple-insert and special tools designed for specific jobs. Mounting methods are given.

Circle Item 551 on Inquiry Card



Metal-Finishing

Lea Mfg. Co., Waterbury, Conn. Reference guide containing condensed information on materials and compounds for such finishing operations as buffing, burring, polishing, and satin finishing. There is also a section on additives and brighteners.

Circle Item 557 on Inquiry Card



Boring and Drilling Machine

American Tool Works Co., Cincinnati, Ohio. Bulletin 813-A discussing applications and specifications of a 19-inch column, traveling open-side boring and drilling machine for work on heat-exchanger plates, engine bases, and structural steel.

Circle Item 558 on Inquiry Card



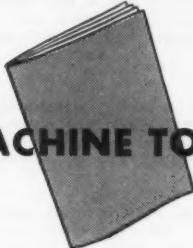
Brazed Tools and Carbide Blanks

Valenite Metals, division of Valeron Corporation, Royal Oak, Mich. Catalogue No. GC-61A on Valenite's standard blanks, brazed tools, and pre-formed carbide. Standard blanks are listed, including rectangular shapes, squares and diamonds, etc.

Circle Item 558 on Inquiry Card

catalogues . . . bulletins . . . manuals

- Yours for the asking . . . use postcard on following page



MACHINE TOOLS

To obtain the Landis "Condensed General Catalog" featuring their complete line of **THREADING** equipment. Circle 2-3

G. A. GRAY offers specific bulletins on each of their: **PLANNER**, **BORING**, **DRILLING**, etc. **MACHINES**. For additional information and correct bulletin numbers, see page 16-17

To obtain the Blanchard Mch. Co's booklet "The Art of Blanchard Surface Grinding" (ground finishes to 2-micromes, Flatness to 1-Light band) Circle 54

For complete information about the newest of the Erie Foundry "Custom or Standard built" C-Frame **HYDRAULIC PRESSES**. Circle 62

Steelweld catalog lists their complete line of **SHEARS**—Available in all sizes. To obtain circle 68

Armstrong Blum offers catalog on their "Marvel #81" series single cut or automatic shuttle type Bar Feed production **BAND SAWS**. To obtain circle 72

To obtain the Induction Heating Co's new 56-page catalog of facts about their electronic low Frequency Motor Generator **INDUCTION-HEATING** equipment. Circle 185

Circular Tool Co. offers a catalog showing more than 1200 items in their line of **SAWS**, **SLITTERS**, Combination Center **DRILLS** etc. To obtain circle .. 189

Federal offers catalog and price list on their Dial Feed **PRESSES**, performs up to 20 multiple station operations—7 to 125 ton capacities—Dial can be powered from press crankshaft or independent motor. To obtain circle 191

Le Blond Mch Co. offers new descriptive bulletin on their line of Tape Controlled **LATHES**. To obtain circle ... 194-195

New Sheldon Mch 3-R **TURRET LATHES**, for 8-station production machining. To obtain booklet giving complete specifications and tooling data circle ... 198

For detailed information on the Goss & De Leeuw line of **AUTOMATIC CHUCKERS** circle 202

To obtain literature and technical data on the Winslow Engineering's completely automatic **DRILL POINTERS**. Circle 212B

Gallmeyer Livingston offer literature on their O.D. & I.D. **GRINDERS** for both internal and cylindrical grinding. To obtain circle 224-225

Benchmaster Co. offers catalog describing their complete line of **PUNCH PRESSES** and pressroom accessories. To obtain circle 232B

Literature available on **KEYSEATERS**, featuring the Davis Keyseater multiple tooth cutter principle. To obtain circle 234B

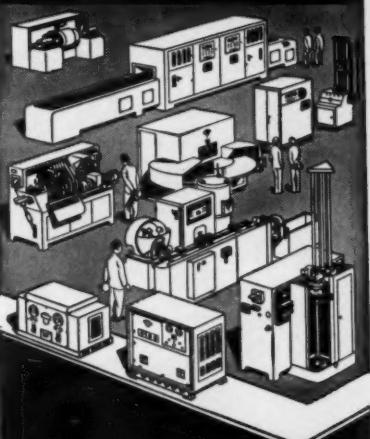
Johnson Co. offers new illustrated catalog describing all models and accessories of their Metal cutting **BAND SAWS**. To obtain circle 235

Pacific Presses offers brochure on their line of hydraulic **SHEARS**. Able to cut through heavy plate or tissue thin metal. To obtain circle 237A

Heald Mch. offers bulletin giving complete information on their numerically controlled **DRILLING MACHINES**. To obtain circle Cover II



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SOLDERING • FORGING • HEATING
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EQUIPMENT

ELECTRONIC • LOW FREQUENCY
MOTOR GENERATOR

THER-MONIC features

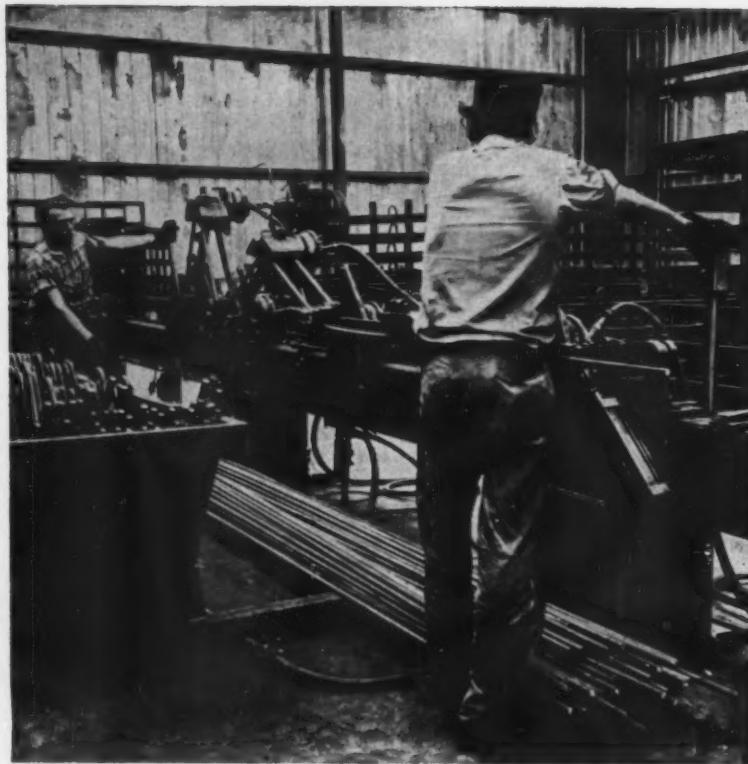
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"WE BEND BAR JOIST WEBS THREE TIMES AS FAST"

Arthur S. Guille, Pres., Guille Steel Products Company, Norfolk, Va., says, "Prior to our purchase of a Zig-Zag® Web Bender, all webs were bent by hand, one bend at a time on a horizontal plane. It was necessary to move bar stock forward and flip it for each successive bend. The resulting web often lacked evenness in panel point spacing, causing delays on the welding assembly line.

"The Zig-Zag Web Bender bends webs three times faster than our previous method with no increase in personnel. Webs are completely bent in 45 secs. to 2½ minutes, depending on the size of the web. In addition, we get much greater accuracy in depth, pitch and radius of our bends 8" to 24". This means faster, stronger welds."

If you bend bar joist webs, contact National Bending Machinery Corp. today for more information about continuous bending with a Zig-Zag Web Bender.



National Bending Machinery Corp.
104 STATION STREET • JOHNSTOWN, PA.

Continued from page 185

Ruthman Co. offers catalog on their Gusher precision built PUMPS—electronically balanced to cut vibrations to a minimum. To obtain circle 196

S. P. Mfg. Co. offers bulletins on each of their series of AIR & OIL BOOSTERS, for additional information and correct catalog numbers see advertisement on page 228A

Eonic offers a new bulletin—featuring complete details about, and outlining savings that can be obtained through the use of their CAMS. To obtain circle 233A

Eisler Engineering Co. offers catalog on their CAMS. All type and sizes made to your specifications. To obtain circle 233D

To obtain engineering data on the Zagar Company's DRILL HEADS, for drilling and tapping. Circle 233E



Universal Engineering offers a completely new catalog on their line of Steel & Stainless Steel JIG FIXTURES, components and clamp assemblies. To obtain circle 56

Ex-Cell-O offers a Buyers Guide and Price List Catalog on their JIGS and FIXTURES. Catalog lists hundreds of parts, assemblies, specifications and prices. To obtain circle 65

Texaco announces a new booklet "Clear-tex Cure." Learn how to end the cutting oil dilution problem and increase the life of your tools. To obtain circle 70

To obtain information on the variety and uses of Oakites CLEANER'S. Circle 213

Buck Tool Co. offers a new catalog on their line of Manual and Power CHUCKS. To obtain circle 216

To obtain a new catalog on the Hamilton Tool Company's PORTABLE ELEVATING TABLE. Circle 217

Lubriplate Div. Fiske Bros. "Data Book" features their grease and fluid type LUBRICANTS. To obtain circle 232A

Opto-Metric offers an 8-page catalog on their Leitz Optical JIG BORER—Spindle head tilts for oblique holes up to 15° from vertical. To obtain circle .. 237B

**feel free to use cards below . . .
to obtain free literature on products
advertised or described in this issue**

1. Circle page numbers of advertisements—if no page number appears on ad, refer to advertisers' index.
2. Circle item numbers of new equipment, catalog descriptions.
3. Mail . . . we'll do the rest.

For Advertisements—Circle Page Numbers

1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
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For New Equipment, Catalogues—Circle Item Numbers

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For New Equipment, Catalogues—Circle Item Numbers

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information center

Reverse side of this card gives instructions on how to use postcards below to obtain new catalogues, data on new equipment described, and products advertised in this issue.

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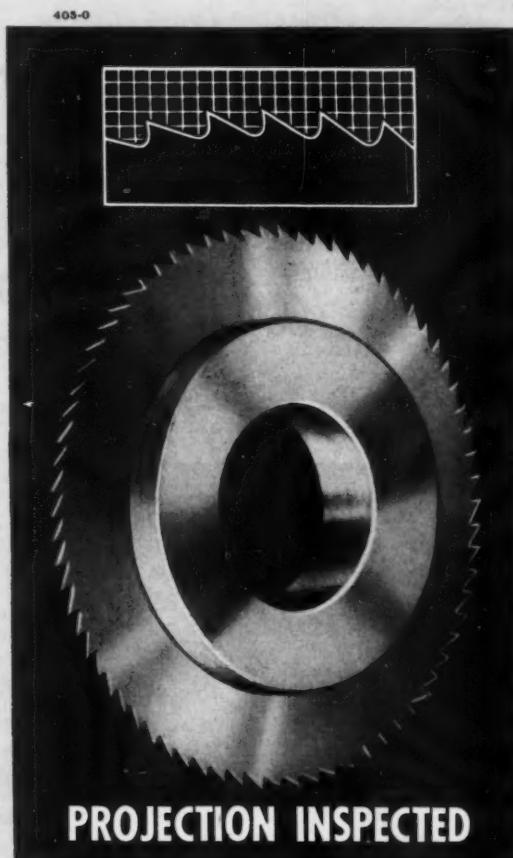
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CIRCULAR TOOL CO., INC.

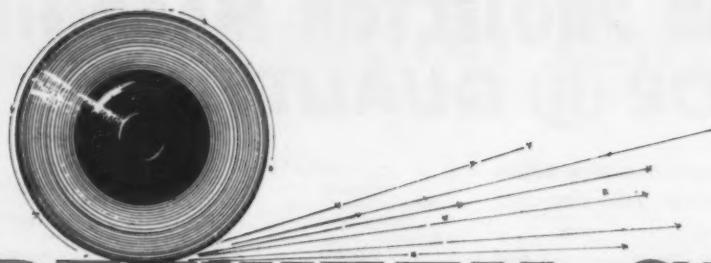
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Specialists in Circular Cutting Tools Since 1923



SOLID CARBIDE SLOTTING SAWS



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By E. S. Salichs

BETWEEN GRINDS

Missile Messenger

The Elkton Robot used at the Remote Controlled Laboratory of Thiokol Chemical Corporation in Elkton, Md., was created specifically for rocket-engine research, and has the dangerous job of transporting experimental rocket motors and propellant compounds from the laboratory to the testing area. In appearance, he differs from the general run of robots in that he has only one hand and arm. But don't underestimate him—he weighs about 400 pounds, can extend his height to a full 10 feet, and travels at about 2 miles an hour. And when he grasps something—well, he just doesn't need two hands.

Hinges Without Twinges

The Hercules Powder Co. is making hinges of molded plastic, and tests reveal that repeated flexing actually increases the tensile

strength of the plastic. The reason behind this phenomenon remains unknown. We will accept the mystery, happy in the thought that maybe our refrigerator and car doors will be getting stronger with use when everything else we own is getting weaker.

But Use All the Parts

Now there is a do-it-yourself helicopter kit available. When completed (note that little factor), it will be 10 feet long, weigh 275 pounds, cruise at 65 miles per hour with a top speed of 85, and fly as high as 12,000 feet. You build the helicopter from factory-approved plans; we did not say family-approved, remember.

Stab at Lab

According to a Westinghouse chemist, a computer has now been taught a technique for solving com-

plicated chemical problems. The brain takes the standard language of the chemist, translates it into the language of mathematics, solves the problem, then feeds back the answer in terms even a first-year chemistry student can understand. In less than ten minutes the computer does what formerly would require two or three days' work—at that from experts, we assume.

Noiseless News

Research on music while you work revealed that rhythmic music is best for industrial workers, whereas ballads and more romantic tunes get greater output from clerical workers. But music in the air, it was stated, "is all wrong for places that require high concentration, such as editorial offices . . ." Amen.

Going up in a Girdle

In *Saturday Review* we read how man—in particular, one Harold M. Graham—is learning to fly in a steam-powered corset. The garment is fashioned of fiberglass and molded to fit the back and hips of its wearer, who slips his arms through two arm rings. Extending from each of the rings is a metal tube, the one on the left ending in a steering stick and the one on the right in a hand throttle. By squeezing the throttle, the flier opens a valve in a small fuel tank mounted on his shoulders, and away he goes. The United States Army Transportation Research Command is sponsoring the steam-jet corset. Which figures.

In a Nutshell

IBM has developed a 6-ounce drum to hold 100,000 bits of information. The drum, according to *Industrial Research Newsletter*, is made of thin stainless steel and is 3 inches long and 3 inches in diameter, spinning at 6000 rpm within a lightweight frame.



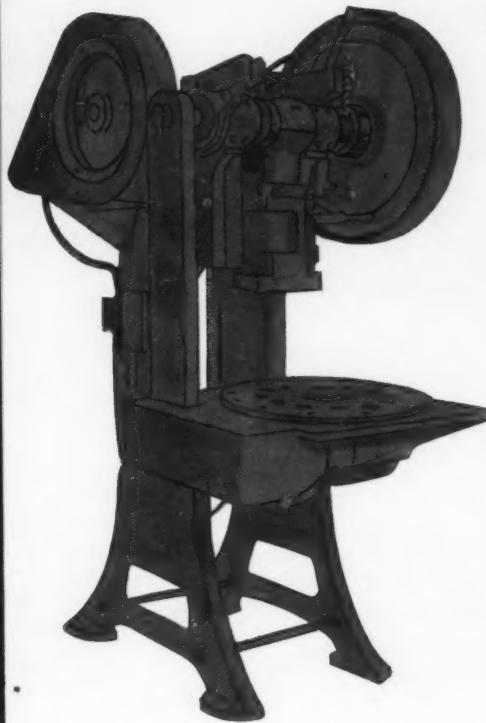
GOOD NEWS—Charles H. Wick, who had severed his fourteen-year association with **MACHINERY** in January, 1960, is returning to our editorial staff this month as midwestern editor with headquarters in Detroit, Mich. Many feature articles that appeared in **MACHINERY** were the result of Mr. Wick's careful research and field work and precise technical editing during the eight years that he was an associate editor and then the six years that he was managing editor. Mr. Wick is terminating his present position as a vice-president with Dudgeon, Taylor & Bruske, Inc., and also his connection as contributing editor with Hitchcock's *Machine and Tool Blue Book*. Now, quoting Editor Charles O. Herb: "Happy to welcome you back, Charlie. Let's go!"

↓

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VERSATILE—up to 20 multiple stations on hundreds of applications.

ECONOMICAL—eliminates need for specialized, high-priced equipment.

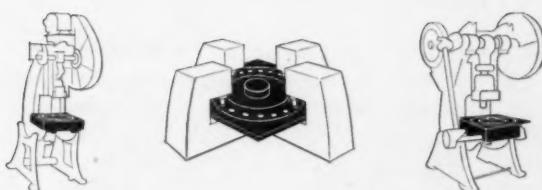


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Federal Dial Feeds deliver the economies of automation—on countless applications—at far lower costs than specialized high-priced equipment. Federals perform up to 20 multiple station operations—deliver up to 300 indexes per minute. Hardened and ground indexing cam assures supreme accuracy and smooth, vibration-free operation. Safety mechanism stops press before die contact, if misalignment should occur for any reason. Can be furnished with automatic parts-feeding and ejecting device. Seven to 125 ton capacities. Dial is powered by gear or chain drive from press crankshaft or directly from independent motor. Check comparison chart below. Write today for new catalog and prices.

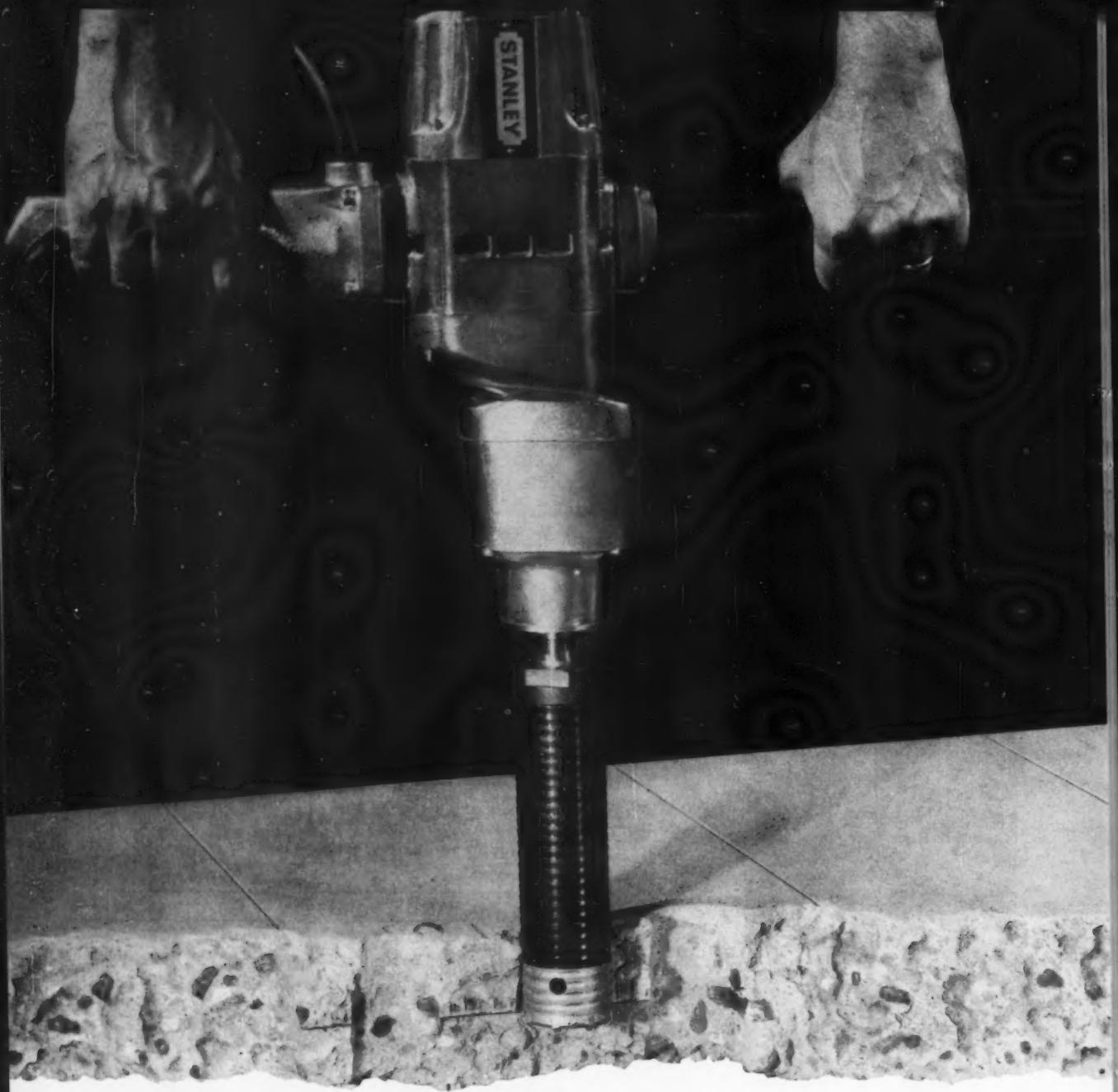
FEATURES	FEDERAL	DIAL "A"	DIAL "B"
Anti-friction bearings	Yes	No	No
Meehanite castings	Yes	No	No
Shear pin protection	Yes	Yes	No
Precision without lock pins	Yes	Yes	No
Accuracy guaranteed	Yes	No	No
Checks alignment each index for die protection	Yes	No	No
Low acceleration and deceleration	Yes	No	No
Gear or chain drive	Yes	No	No
Hardened and ground indexing cam	Yes	No	No
Automatic lubrication	Yes	No	No

FEDERAL
dial feed
PRESSES



Use Federal Indexing Tables on your present equipment, or independently with air cylinders, drilling and tapping heads, staking presses, drill presses and other tooling.

THE FEDERAL PRESS COMPANY of Elkhart, Indiana, Dept. 901



Built to drill reinforced concrete

Stanley No. 404 portable drill gets critical strength from gears and pinions of Nickel alloy steel.

This electrically powered impact drill is designed to cut through reinforced concrete, brick, stone, masonry materials, and concrete pipe . . . *without deflection*. It can drill holes or cut cores in any diameter from $\frac{3}{8}$ " to 4" without chipping, cracking or breaking out when close to an edge.

To give this hard-hitting drill built-in stamina, Stanley engineers specify carburized AISI 4620 (1.8% nickel) for critical parts of the power train. The hard case and tough core of this nickel alloy steel stand up to the severe

operating shocks of impact drilling . . . provide outstanding resistance to fatigue and wear.

When you design, order, or use heavily stressed machine components, remember that nickel alloy steels take the tough jobs in stride. For helpful engineering data on these alloys write to Inco. We'll be glad to help.

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INCO NICKEL
Nickel makes alloys perform better longer

allows added flexibility. These include comparator systems, regeneration systems, and a combination of both. The illustration shows a tape-to-tape regeneration comparator system (two motorized tape readers connected with a motorized tape punch). It insures accurate and speedy verification and duplication of tapes punched by the Flexowriter automatic writing machine (foreground) or other tape-producing machines.

In one of the three comparator systems, two Friden motorized tape readers are connected for automatic verification of tapes recently duplicated. In numerical-

control systems application, for example, a tape duplicated from one that has been in use for some time is compared with the original. The two tapes are placed one in each reader and read simultaneously at 1200 codes per minute. If an error is detected in the new tape, the reader will stop, indicating to the operator the exact position on the punched tape.

Other Friden comparator systems are combined with regeneration systems equipment to allow tapes to be verified and duplicated simultaneously, thus saving an additional handling of the tape. Information already punched in

short individual tapes can be duplicated and compared automatically and combined into one continuous tape at twenty codes per second. A long composite tape facilitates the input of data for wire transmission, computers, tape-to-card converters, address-plate embossing machines, recording instruments, and other tape-operated equipment. In addition to tapes, edge cards may now be duplicated automatically with a Friden regeneration system composed of a motorized (tape or edge card) reader connected to a motorized (tape or edge card) punch.

Circle 601 on Readers' Service Card

under the weight of a full 2-inch by 12-foot wide plate of steel.

The machine is controlled by a simple hand-held thumb-operated button. A finish of 60 to 100 micro-inches on aluminum is routine and

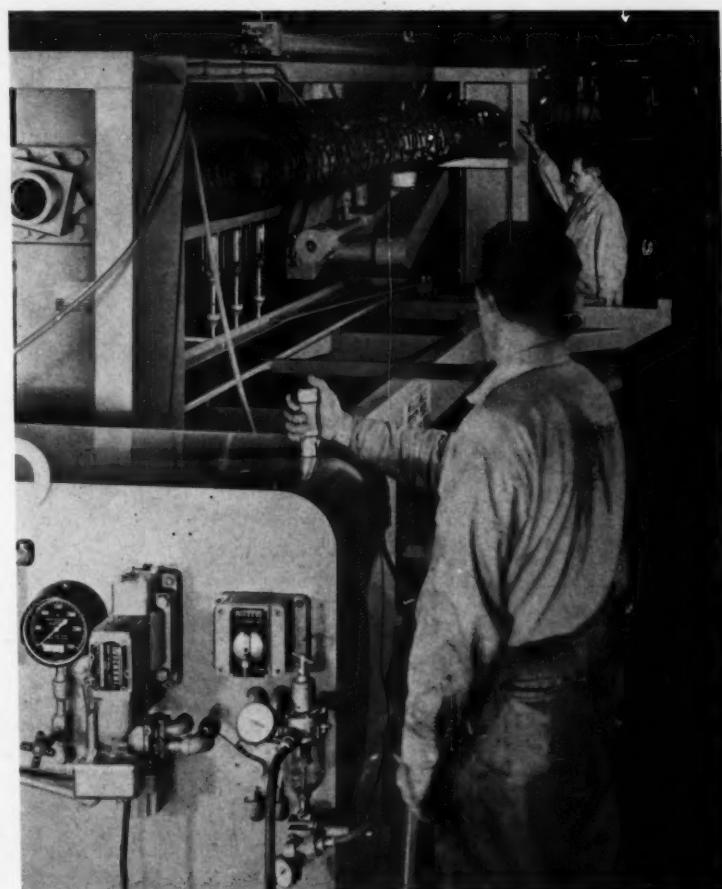
Wallace Plate-Cutting Machine

A new plate-cutting machine designed to cut both ferrous and nonferrous metals has been announced by the Wallace Supplies Mfg. Co., Chicago, Ill. With the unit set up to cut nonferrous metals the cutting head is locked into a fixed position and traversed the width of the bed, which is 12 feet in the case of the model illustrated. The traversing speed is variable. The cutting is done with carbide-tipped wheels.

Aluminum plate 1 inch by 12 feet can be cut in less than one minute. The cut surface has a smooth finish and the edges are clean-cut. Aluminum plate 4 inches thick can be cut at the rate of 4 feet or more per minute.

With the unit set for ferrous or steel alloys the head is unlocked to permit the abrasive wheel to "sense" its way through the cut as it oscillates in its alternating forward and reverse motion through the plate. Cuts are completed at the rate of three or less seconds per square inch. The maximum cutting speed for a plate 2 inches by 10 feet is twelve minutes. Larger size 26-inch diameter wheel units can cut 4-inch stainless plate with two perfectly square straight edges in less than twenty-four minutes, with no change in the metallurgical quality of the plate.

The machine carries the cutting head on turned and ground round bars which are fully enclosed in bellows type protectors. The change-over from "oscillating fer-



Wallace plate-cutting machine designed for rapid, accurate cutting of both aluminum and steel plate





First from LeBlond

Continuous-Path Tape Controlled Lathes

Talk to LeBlond about Tape-Turn lathes. You'll be talking about machines we've got on the run off floor rather than on the drawing board. We're delivering at least six months ahead of competition. Our experience can help you get an important edge on *your* competition.

Tape-Turn is being built with 20 to 75 hp in sizes from 2013 to 4025.

100% tape commanded by G. E. Mark Century control—all operator controls at the console—solid state components (no tubes, stepping switches or rotating parts)—temperature and humidity controlled—built-in computer for linear and circular interpolation.

Benefits

Increased efficiency and management control, reduced lead time, a permanent record in easily-stored form, low-cost quality control, reduced parts inventory, shorter set-up time and lower tooling costs.

Ask to have a LeBlond field engineer stop and talk Tape-Turn, the machine on the floor instead of the drawing board. Or write for our new descriptive bulletin TT-1061 H.

The R. K. LeBlond Machine Tool Company
Cincinnati 8, Ohio

*Leading the way
in numerically-controlled
turning.*



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Circle page number on Readers' Service Card

196

under 125 micro-inches is normal for steel.

Accessories include a built-in mist coolant system that feeds the mist onto the carbide cutting wheel automatically through the

wheel guard when cutting non-ferrous metal. Air clamps must be engaged to move the unit. The gage unit shown is standard equipment.

Circle 602 on Readers' Service Card

C-H Industries Thread-Chasing Tool



Thread-chasing tool brought out by C-H Industries

A tool designed for chasing internal and external threads has been announced by C-H Industries, Wallingford, Pa. The unit can be set up in any modern toolholder, and accepts external threading tool bits as well as internal boring tools. The toolholder has a travel of 0.210 inch in either direction with a beyond-center lock, repeating within 0.0005 inch. This permits the threading tool to be quickly withdrawn from the work, without reversing the cross-feed screw.

These features have been developed to appreciably increase production, eliminate the possibilities of errors, and reduce lead-screw wear. The tool may be obtained individually or with a kit including six threading tools. An adapter is also available permitting the use of the tool on any standard toolpost. Thin-wall tube cutoff, chamfering, and grooving operations are also made easier with the new "Flogaus" threading tool.

Circle 603 on Readers' Service Card

Continuous Automatic Finishing Machine

Pangborn Corporation, Hagerstown, Md., has announced a new line of fully automatic continuous-process vibratory gyrators for high-production precision finishing of metal, plastic, or ceramic parts. Work may be fed or conveyed automatically into and out of these machines. The finishing media are automatically cleaned, screened, and recirculated. Compound and water are added automatically. No one need be near the machine, which operates without supervision.



Pangborn automatic vibratory finishing machine

MACHINERY, September, 1961

Cleaning, descaling, deburring, radiusing, grinding, fine-finishing, coloring, and burnishing may be accomplished with the same precision as in standard type operations. These continuous-process machines use the same gyratory action and special air-cushion suspension as standard type units. Arrangements can be made for continuous conveyance of large and heavy fixture-held parts through these machines. The elongated work containers also may be adapted to batch type processing of very long parts. The machines are available in a range of sizes.

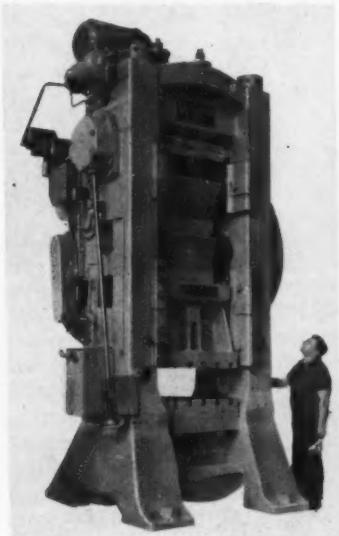
Circle 604 on Readers' Service Card

Warco Knuckle-Joint Presses

Warco single back-gearied knuckle-joint presses like the 600-ton model shown, arranged with die-area lighting, are available from the Federal-Warco Division, Warren, Ohio, in sizes ranging from 100 to 2500 tons.

These knuckle-joint presses are designed for such press work as coining, extruding, cold-forming, sizing, swaging, heading, and embossing. Manual or automatic feeding devices are available for fast material handling for high-speed production. The presses are equipped with Warco's pneumatic friction clutch and brake unit.

Circle 605 on Readers' Service Card



Warco 600-ton knuckle-joint press

MACHINERY, September, 1961



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You can improve your product with permanent indentation marking. From engraved hand stamps to special automated machines SCHMIDT can assure you of dependable marking equipment properly engineered for your job. It's just good business to be acquainted with the complete SCHMIDT line. Write for catalog or contact your local GTS marking specialist for complete information.

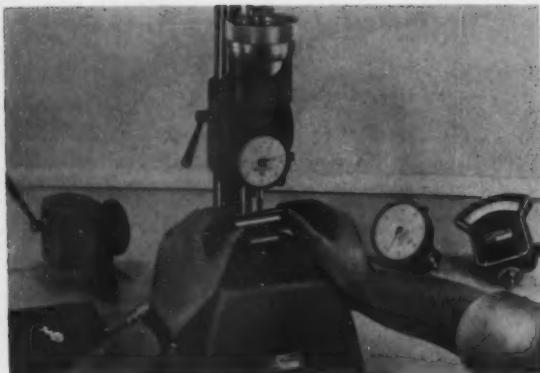


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For more data, circle this page number on Readers' Service Card.



Federal multiple-choice comparator offering a wide selection of gaging methods and accessories



Red Ring gear analyzer that simultaneously checks gears for eccentricity, tooth action, and size

For { **8-STATION PRODUCTION MACHINING
1½" BAR AND COLLET WORK
CHUCKING
SINGLE POINT THREADING**

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading. Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret.

The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

Costs { **\$7,167.00**

FOB Factory
Complete with all
standard equipment

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling.

For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.



Write for bulletin with complete specifications and tooling data

SHELDON MACHINE CO., INC.
4246 N. Knox Ave. • Chicago 41, ILL.
Builders of 10", 11", 13", 15" Sheldon lathes, Sheldon Milling Machines,
Sheldon Shapers and Sebastian Geared Head Lathes

Multiple-Choice Comparator

A versatile, high-precision comparator, offering a wide selection of gaging methods and accessories, is announced by Federal Products Corporation, Providence, R. I. This comparator consists of a sturdy base and precision column on which the user can assemble his choice of dial-indicator gaging units or air, electric, or electronic gage heads. Increasing the adaptability of the comparator are a variety of interchangeable reference surfaces.

One combination features a micrometer head with a 0.0001-inch dial indicator. By utilizing the 1-inch range of the micrometer, settings up to 8 inches can be made, using only three gage-blocks. Among the choices of reference surfaces are a reversible anvil, a serrated platen, a roller V-block, and precision centers.

Circle 606 on Readers' Service Card

Red Ring Inertia Type Gear Analyzer

A compact Red Ring rolling-fixure type of gear analyzer that utilizes inertia principles and electrical indicators to provide three simultaneous precision measurements of gear-tooth accuracy has been developed by the National Broach & Machine Co., Detroit, Mich. This equipment will detect nicks on tooth profiles as small as 0.0005 inch high.

The inertia type gear analyzer illustrated has a pivoted motorized master gear that is meshed with

the gear to be inspected and rotated. Center-distance movements of the master gear are detected by three electrical indicators to provide separate measurements of work gear-tooth eccentricity, tooth-to-tooth variation, and tooth oversize and undersize conditions.

Measurements of the electrical indicators are transmitted to a panel unit, where a red light shows a reject gear and at the same time another light shows the particular error that caused the rejection. A large dial in the panel

unit gives visual indication of the eccentricity measurement. Another control permits adjustment of the master-gear rotating speed. The indicator unit for the separate tooth-to-tooth measurement utilizes an unusual inertial type of mechanical movement for which applications have been made for patents.

To analyze a gear, the device is first set up with master pitch cylinders and the master gear mounted in their correct positions. A work gear is lowered over its

mounting shaft and meshed with the master gear. At the bottom of its downward motion, the work gear actuates a cycle switch that energizes a timer to delay checking until the work gear completes one revolution. The gear is analyzed on the next revolution. The signal lights tell the inspector the three-property tolerance condition of the work gear. At the end of the analysis, the inspector pushes down on a lever control to raise the work gear to permit removal.

Circle 607 on Readers' Service Card

Optical Gage

A DR-25B optical gage, which provides absolute measurements to 0.0001 inch for routine production, has been developed by Bausch & Lomb, Inc., Rochester, N. Y. This instrument is accurate to 0.000025 inch (25 millionths of an inch) and operates within normal temperature ranges without correction tables. It will measure parts directly, completely eliminating gage-blocks or master set-ups.



Bausch & Lomb gage for laboratory or production gaging

The instrument incorporates a precision-ruled scale (not subject to error from wear) and is adapted for the gaging of parts on which a number of dimensions must be checked.

Precision measurements can be made from 0 to 3 inches. Over a

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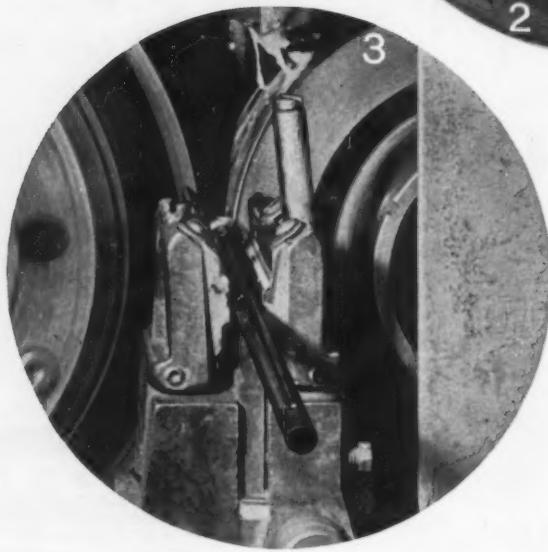
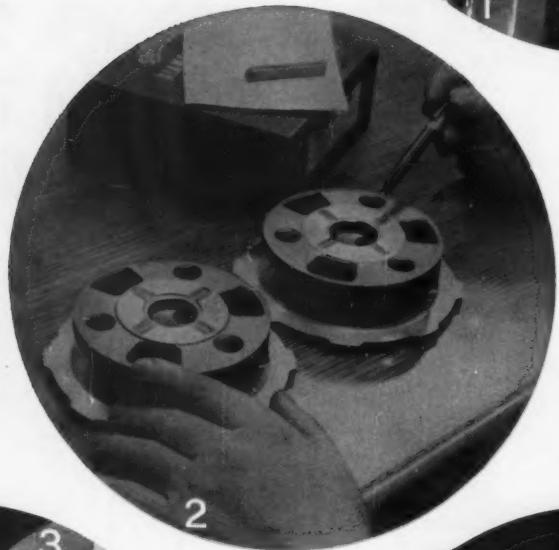
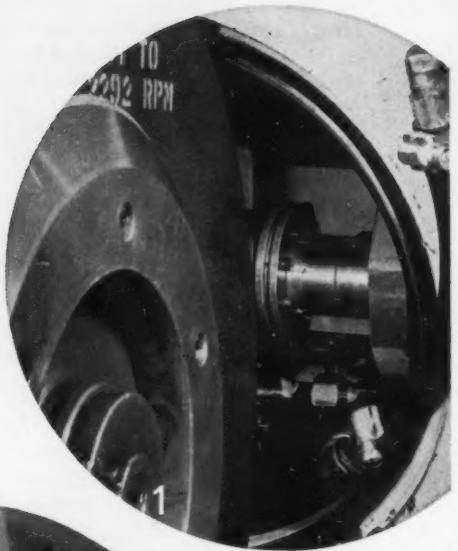
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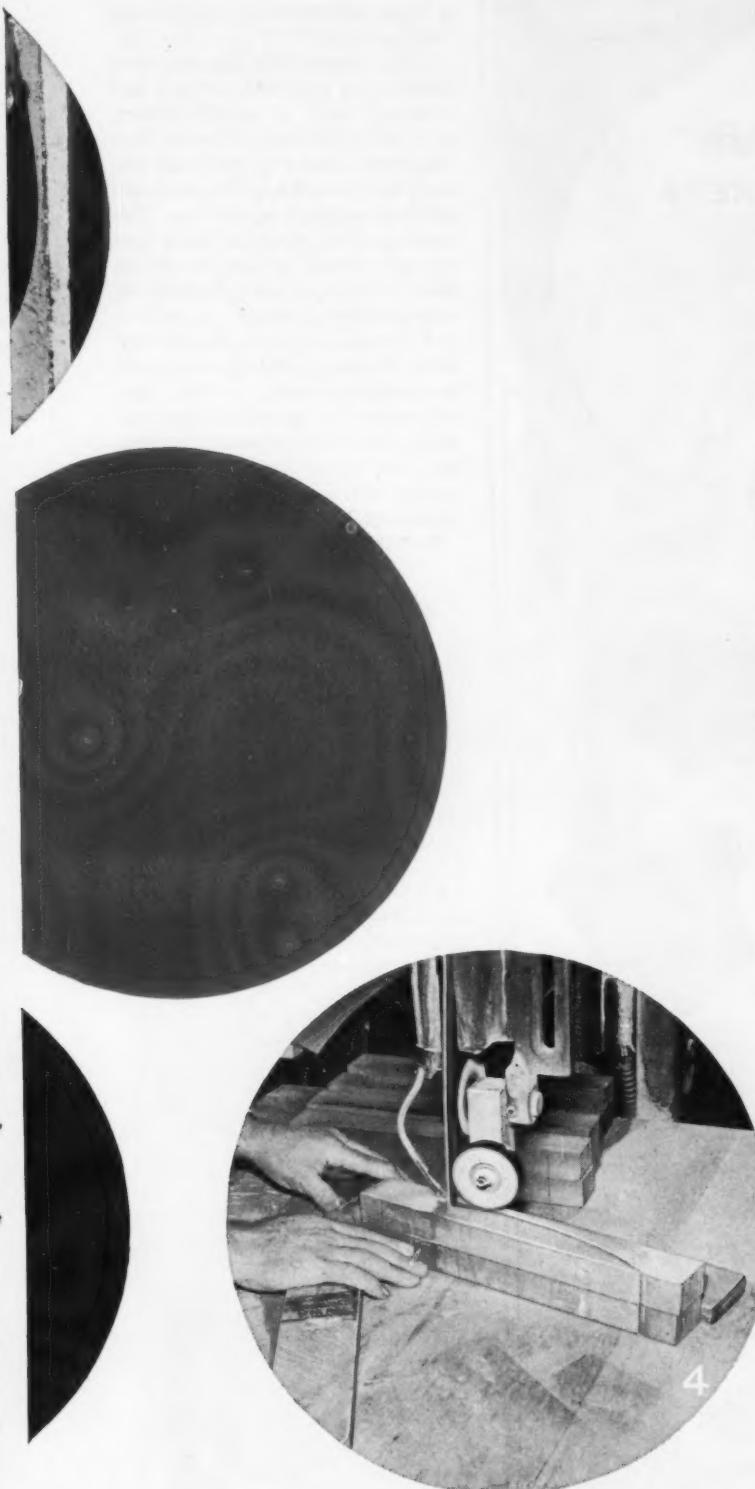


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Each of these jobs is done better and cheaper with natural diamonds

Here are four cutting and grinding operations being performed with industrial diamonds.

Three of them were once done with other kinds of tools. One couldn't be done at all, were it not for the unique *combination* of properties that only diamonds possess—excellent cutting ability coupled with fantastic endurance.

Result: your people spend less time changing tools, more time actually producing.

If you cut, sharpen or smooth in your business, you can probably use diamonds to advantage. Test them against the method you're using. You'll find out how efficient—and economical—a diamond can be, especially now.

Best grit for metal-bond wheels developed by the Diamond Research Laboratory in Johannesburg

A new impact crushing method for natural diamonds is producing the strongest and most durable diamond grit ever obtained for metal-bond wheels. Your tool and wheel manufacturer is ready to help you select the diamond tool that's right for your job.

1 Dressing Grinding Wheels that groove propeller shafts for Evinrude Motors, Milwaukee. Cutters are powdered metal matrix impregnated with small, blocky natural diamonds. They show no wear after months of use.

2 Boring and Facing Aluminum pinion carriers for Chrysler Corporation, Detroit. Dimensions are held within $\pm .001$ inch, producing finishes to 20 microinches. Conventional tools could not withstand aluminum's abrasiveness, nor meet these tolerances.

3 Grinding Synthetic Sapphire and quartz rods with diamond grinding wheel. Tolerances for diameters: $\pm .0002$ inch; concentricity: $\pm .0002$ inch. After trying every other grinding method, this diamond-coated unit was installed by Duncan-Inglewood, Inc., Inglewood, Calif. Rods are now being turned out on a production basis.

4 Band-Sawing Optical Glass. New diamond-coated band-saw blade cuts optical glass to pattern shapes at Dia-Chrome, Inc., Glendale, Calif. Diamond band saw can also cut reinforced plastics, ceramics, marble. Thin materials can be cut without coolant; dense materials require water or water-oil emulsion.

Industrial diamonds cut practically everything...especially your production costs

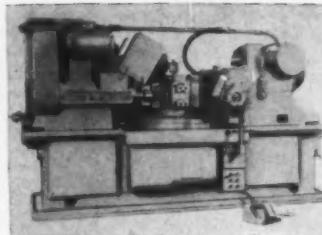
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GOSS and DELEEUW
AUTOMATIC CHUCKERS
offer the 1-2-3 feature**



This NEW development unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy change-over. Any class of chuck work can be handled economically in any quantity.



The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR

detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.



GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

temperature range of 31 to 105 degrees, the maximum correction for a 3-inch dimension in steel is only 0.0001 inch.

Each instrument has an anvil adapter which will accept any standard anvil or special fixture. A 3.5-inch diameter circular, serrated anvil and a 4-by-6-inch rectangular, serrated anvil are available as optional equipment. The unit has been designed for a foot control switch (optional) which frees the operator's hand for manipulating parts.

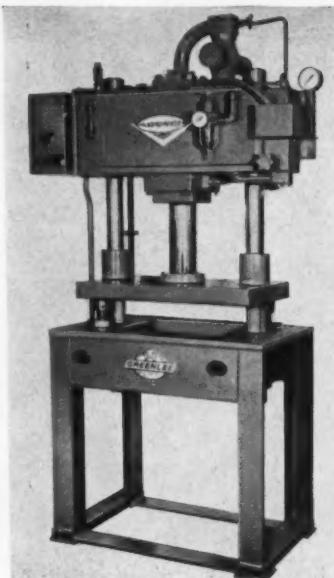
A standard spindle tip is supplied, but any AGD tip can be accommodated. An optical fine adjustment is provided to precisely zero the instrument by simply turning a knob. The gage weighs 60 pounds and is 21 1/4 by 11 3/4 by 10 3/4 inches.

Circle 608 on Readers' Service Card

**Two-Bar Hydraulic
Trimming Press**

A two-bar trimming press that exerts 20 tons of working pressure in the trimming stroke has been introduced by the B & T Machinery Division of Greenlee Bros. & Co., Holland, Mich. High approach velocity and slow shearing speed result in clean, neatly sheared castings.

Faster operation of this press is secured by means of a pressurized



Greenlee B & T trimming press

hydraulic system which virtually eliminates cavitation and air entrainment or entrapment in the hydraulic circuit. The air-pressurized oil is pumped from a 20-gallon reservoir through extra-heavy seamless pipe.

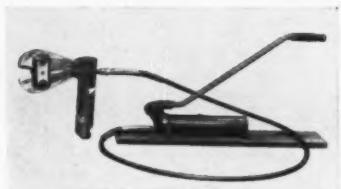
The two 3-inch diameter bars are mounted in a two-bearing arrangement in the base of the press and a similar arrangement at the top. This provides for maximum stability of the frame and moving platen. Each bar is fitted with an adjustable safety stop. Another safety feature prevents starting of the pressing stroke until the casting is in its proper position. All hydraulic components are mounted at the top. Very little floor space is required for this compact press.

Circle 609 on Readers' Service Card

Hand-Operated Hydraulic Rod Cutter

Quick, easy, positive cutting of metals including reinforcing rod up to 5/8 inch in diameter can be accomplished by this new hand-operated hydraulic cutter brought out by H. K. Porter, Inc., Somerville, Mass. This equipment combines hydraulic power with the Porter metal-cutters. It has the advantage of being completely independent of outside power sources and may be taken to the job in the plant or outside in the field. The cutter is easy to use overhead, on the floor, and in confined areas. The Model 1790CD, illustrated, combines a heavy-duty Porter center-cut cutter-head with hydraulic power. This cutter is capable of cutting soft metals through 3/4 inch in diameter and medium-hard metals through 5/8 inch in diameter, such as concrete reinforcing rods, brass, copper, aluminum, steel, iron, and plastics.

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Hydraulic rod cutter

ELDORADO*

HAS OVER 1001 GUN DRILLS IN STOCK



Size-Dia.	Length	Driver
.1250" to .5000"	10", 16", 22", 28", 36"—all diam.	3/4" x 2 3/4"
.5156" to .7500"	16", 22", 36"	1" x 2 3/4"
.7656" to 1.0000"	22", 36"	1 1/4" x 2 3/4"

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...there's ONE to LOWER YOUR
HOLE COSTS!

ELDORADO'S constant inventory of popular size GUN DRILLS is keyed to the needs of the industry, designed to the most exacting specifications! Made to produce economically, straight, round, accurately located, finely finished holes . . . FASTER, In One Single Operation.

Our years of accumulated GUN DRILL making experience and knowledge, plus a complete research and engineering department are yours to take advantage of.

Get these important benefits with ELDORADO

- The world's largest manufacturer of GUN DRILLS—exclusively.
- A complete choice of sizes, lengths, types.
- Eliminate secondary operations—reaming, honing, grinding.
- Save your company money by reducing "cost-per-hole."
- Drill most materials—aluminum, cast iron, brass, tool steel, stainless, etc.
- Drill any shaped part to any depth (sometimes interrupted holes or across existing holes),
- Drill shallow or deep holes to precision tolerances.

Since these extras cost you no more...
your best bet is an ELDORADO GUN DRILL

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Sciaky Electron-Beam Welding Machine



Fig. 1. Electron-beam welder announced by Sciaky Bros., Inc.

An electron-beam welder, Model VX-20-30-48, designed to combine research and production capabilities in one machine has been announced by Sciaky Bros., Inc., Chicago, Ill. The unit shown in Fig. 1 is now being used in the company's welding laboratory, where it is actively engaged in welding various refractory and reactive metals, as well as dissimilar materials.

The vacuum chamber measures 20 by 30 by 48 inches long. This rectangular chamber is designed to afford maximum geometrical spaces. Complete gun mobility takes full advantage of the internal chamber dimensions.

The electron gun, shown diagrammatically in Fig. 2, is provided with traverse motion (Y axis) and vertical motion (Z axis) powered by Sciaky's own speed and position servo control. This control (trade name of Sciakydyne) also effects longitudinal motion (X axis) to the internal work-table. Numerical control is

easily adapted to the Sciakydyne control concept.

The vacuum chamber is pumped to 1×10^{-4} mm. mercury in about four minutes. The pumping sequence is fully automatic. With atmosphere conditions equal, both end doors can be opened. An electron beam of 350 milli-amps at 30 kv can be pro-

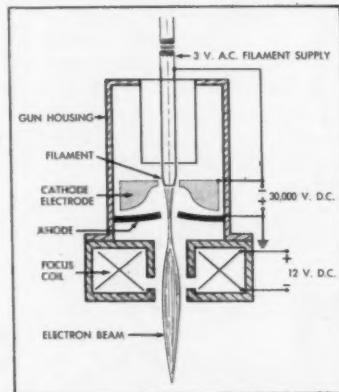


Fig. 2. Electron gun used in beam welder, Fig. 1

Now—Finishes Add Beauty to Tough Malleable Castings

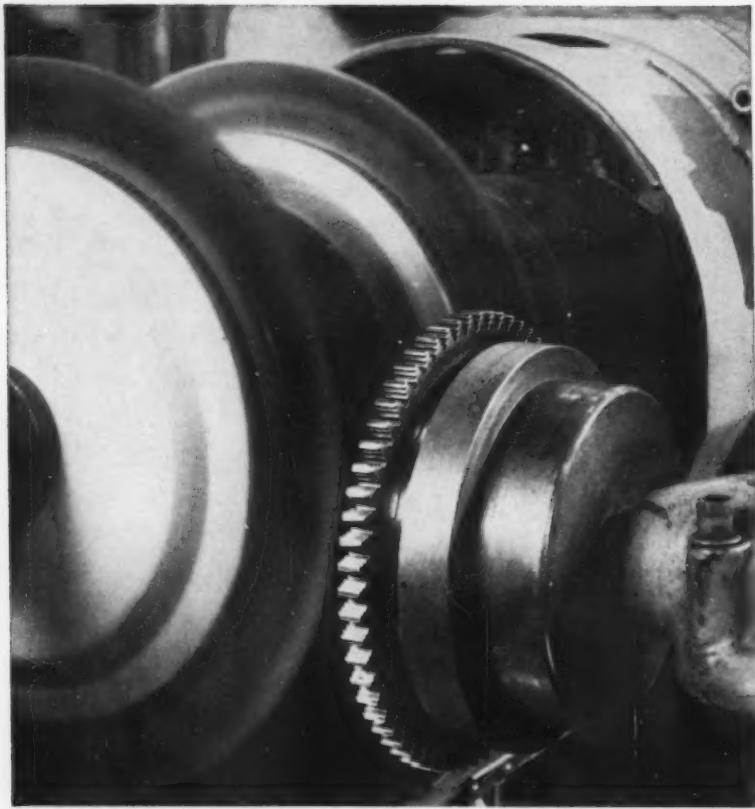
Beautiful, protective finishes on tough Malleable iron castings will give your products a superior combination of appearance, ruggedness, and economy. Get complete information on this sales-getting combination from any of the progressive companies that display this symbol —



New Ideas for your products are suggested in Data Unit No. 115, available free from any member of the Malleable Castings Council, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.



The castings shown have been painted, blued, chromium and cadmium plated, plastic coated, porcelain enameled, galvanized, and machined.



GAS TURBINE DISC DOVETAILS are deburred rapidly, automatically on Osborn 3A Finishing Machine using Osborn 14" Tufmatic® power brushes. Cycle time—floor to floor: 5 minutes . . . 9 times faster than former method.

COST CUT 90% deburring with OSBORN power brushing

Before: deburring the 64 dovetails broached on this gas turbine disc was a problem for this major producer of jet engine components. Off-hand filing was slow and costly . . . took 45 minutes per part . . . cost about \$5.00 per disc.

Now: an Osborn 3A Finishing Machine—equipped with two Osborn Tufmatic® power brushes—deburs the part automatically in just 5 minutes . . . 9 times faster. Finishing cost is down to 50¢ per part . . . a 90% cost reduction. And production quality is consistently higher, more uniform.

Osborn power brushes and advanced brushing methods can help you save time and money on metal finishing operations of every description—deburring, cleaning, polishing, precision blending. An Osborn Brushing Analysis—made at no obligation in your plant now—is the first step to savings like these. Write or call *The Osborn Manufacturing Company, Dept. D-66, Cleveland 14, Ohio. Phone ENDicott 1-1900.*



Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

duced by the electron gun and associated power supply. The beam spot can be focused into a 0.030-inch minimum diameter and over 1.0-inch maximum diameter.

Recently, this low-voltage system successfully welded 1 3/4-inch aluminum plate with a depth-to-width ratio of 22 to 1. Typical weld settings for various alloys are listed in Bulletin No. 344, now available.

Circle 611 on Readers' Service Card

Red Ring Process Produces Ultraprecision Lead Bars and Follower Nuts

A Red Ring process for producing ultraprecision lead bars and follower nuts for broaching machines, spline grinding machines, special machine tools, and inspection fixtures has been developed by the National Broach & Machine Co., Detroit, Mich. With this process, the helical grooves in the one-piece high-speed-steel hardened lead bars are ground from the solid on a new specially designed Red Ring precision grinding machine. Leads on 100-inch long bars have been consistently produced to accuracies of less than 0.001 inch by the process.

The follower nut is cast on a precision molding mandrel with babbitt metal to provide a back-



Two lead bars and follower-nut assemblies produced by the new Red Ring grinding process for a dual-ram broaching machine

lash-free combination sliding and rotating precision motion. This mandrel is ground with the same machine setup as the precision lead bar. The lead bars shown in the accompanying illustration are 100 inches long and 3 3/4 inches in diameter and have helical grooves made to a total lead accuracy of 0.0006 inch.

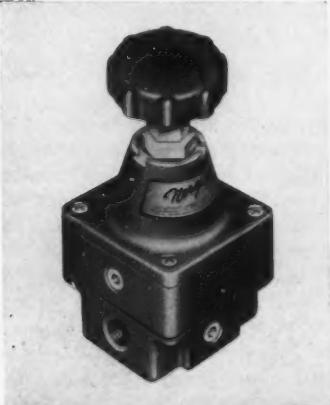
National Broach will supply the custom-built lead bar and nut assemblies to either machine tool builders as original equipment or to machine tool users as replacement parts on existing equipment.

Circle 612 on Readers' Service Card

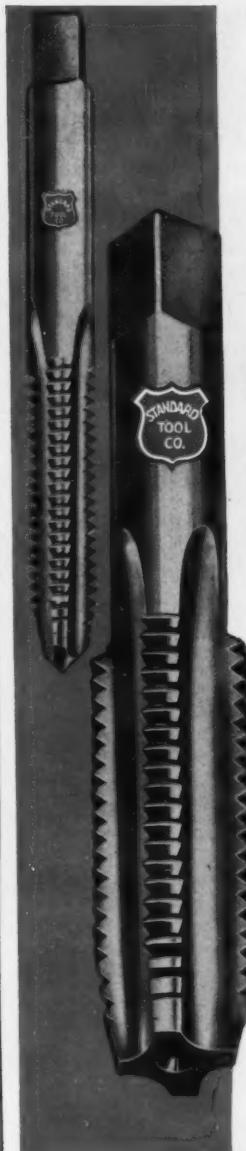
Norgren Precision Air-Pressure Regulator

Precision pressure regulator for air gaging, laboratory use, precision pilot air control, and other applications where exact accuracy and high sensitivity of air-pressure adjustments are required. Introduced by the C. A. Norgren Co., Englewood, Colo., this Type 20AS regulator is accurate even below 1-psi gage pressure. It reduces line pressures of 0 to 150 psig (pounds per square inch gage) to secondary pressures of 0 to 60 psig, and it can be used over a temperature range of 32 to 160 degrees F. It is made for 1/4-inch pipe and provides accurate pressure control up to the maximum air flow recommended for this size pipe. The regulator is said to operate with complete freedom from hunt, hum, and chatter. It has built-in relief, features exact repeatability, and is free from drift over short or long periods of time.

Circle 613 on Readers' Service Card



MACHINERY, September, 1961



...Controlled manufacture of STANDARD'S TAPS...assures these PLUS Features!...

- 1 All flutes are Index ground.
- 2 Flute contours, Hook and Rake Angles Constant, One Tap to another.
- 3 Concentric on all lands—no high or low cutting edges.
- 4 Shanks, outside diameter, pitch diameter and chamfer all in perfect concentricity.

DEPEND upon STANDARD'S Authorized Distributors . . .

For Twist Drills, Reamers, Taps, Counterbores, End Mills, Milling Cutters, Hobs, Gages, Dies, Carbides (solid or tipped) . . . and for Engineering or Technical Information.



STANDARD TOOL CO.

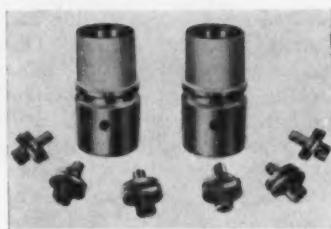
3950 CHESTER AVENUE CLEVELAND 14, OHIO
BRANCH WAREHOUSES IN: NEW YORK - DETROIT - CHICAGO - DALLAS - LOS ANGELES - SAN FRANCISCO



Insulated Bushings for Use in Electrical-Discharge Machining Process

Insulated demountable die-set bushings which permit mounted dies to be machined by the electrical-discharge process introduced by Danly Machine Specialties, Inc., Chicago, Ill. By using the insulated bushings in a die set, and mounting an expendable punch or copper electrode directly on the production punch, the die can be

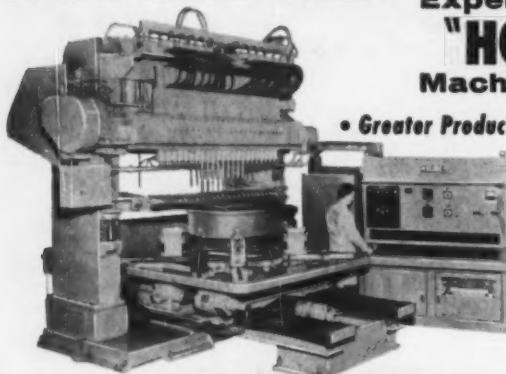
machined to the required accuracy by electrical discharge. The process greatly reduces the mounting and aligning time required when the die is machined before being mounted. The demountable bushings have an insulated surface which contacts the punch-holder and are furnished with insulated mounting clamps. According to Danly, the bushings withstand an electrical potential exceeding 1100 volts, far in excess of the voltage required for electrical machine



purposes. Die sets equipped with the new insulated bushings can be put into production use after machining the die by simply replacing the insulated clamps with standard steel clamps. The new insulated units are stocked in 1-, 1 1/4-, and 1 1/2-inch sizes but can be supplied in other sizes at Danly branches or distributor assembly plants.

Circle 614 on Readers' Service Card

MOLINE MULTI-NUMETRIC



NUMERICAL CONTROL (AS APPLIED TO MULTIPLE SPINDLE DRILLING)

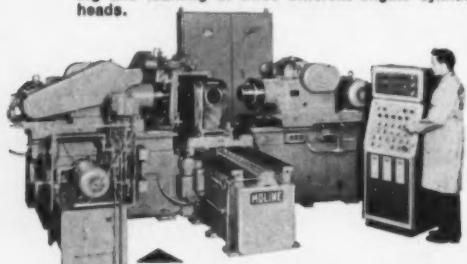
Expertly Designed "HOLE HOG" Machine Tools for—

• Greater Production • Efficiency • Savings!

Model HD88 Tube Sheet Drilling Machine with Multi-Numeric Numerical Control for positioning of machine table in two directions and for selection of spindles. Information on punched tape permits automatic drilling of a complete hole pattern in a tube sheet without interruption.

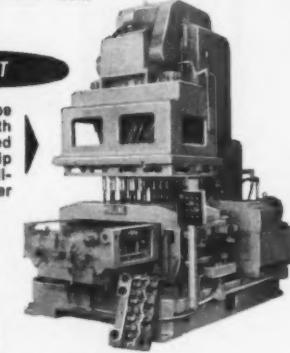
OTHER MOLINE COST REDUCING EQUIPMENT

Model HU111 Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



Model MR148 Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.

HD13 straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.



60 years of Machine Tool Engineering Experience is at your service for

- Multi-Spindle Boring • Single and Multi-Spindle Honing
- Straight Line Multi-Drilling • Adjustable Spindle Drilling
- Special Multiple Operation Machine Tools

Write for Details



MOLINE TOOL COMPANY

100 20th STREET • MOLINE, ILLINOIS

Representatives
in principal cities

Norton "Cut-N-Saucer" Grinding Wheel

Reinforced grinding wheel for weld grinding and light snagging named the "Cut-N-Saucer," announced by the Norton Co., Worcester, Mass. This wheel combines the advantages of saucer-shaped



wheel with the convenience of a throw-away mount. The wheel is available in 7- and 9-inch sizes to fit standard threaded spindles on portable grinding equipment. The saucer shape permits the operator to hold the wheel at a closer angle to the work. This means easier control and less operator fatigue. The permanently attached Discard mount permits the wheel to be installed on the grinder in

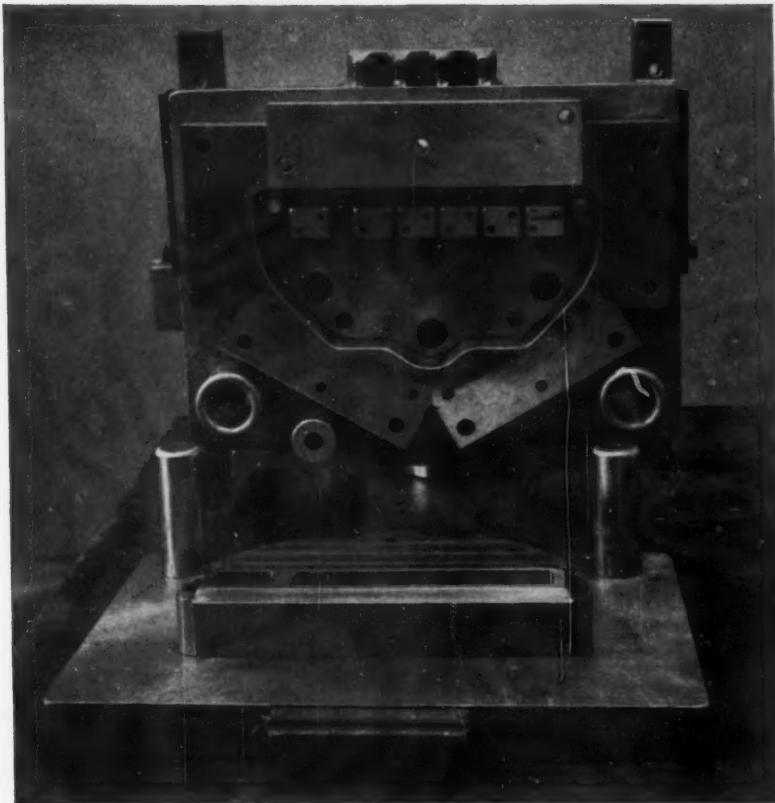


Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Sales Corporation



Bethlehem Brake Die Tool Steel Forms Vacuum-Cleaner Base Plate

At Remmle Engineering, Inc., St. Paul, Minn., they needed a tool steel with high strength to handle a difficult forming operation on sheet steel. The part, a base plate for a vacuum cleaner, was produced by a die made of Bethlehem Brake Die tool steel.

Engineers at Remmle liked Brake Die's well rounded combination of fine mechanical properties. They also found it a time saver because it machined so readily. Best of all, it produced thousands of pieces before slight redressing was required.

This tool steel requires no heat-treatment

Brake Die is ideal for intricate bending and forming dies because it combines high wear-resistance with high strength. It requires no additional heat-treatment because it is furnished in the heat-treated condition, ready for machining into a finished die. Brake Die is quenched and tempered in our shop to develop its superior properties. Then we straighten it mechanically and give it a stress-relief-anneal to remove straightening stresses.

Your Bethlehem tool steel distributor has Brake Die on hand in many sizes and sections, ready for prompt delivery. Give him a call today.

BETHLEHEM TOOL STEEL



ENGINEER SAYS:

*For Uniform Service from Tools,
Control the Surface Chemistry*

One of the most difficult problems in the use of tools is non-uniformity of service life. Absolute uniformity in production from all identical tools is not expected. But wide variations in service life from one tool to another, or from one lot to another, present a real problem.

It has been found that the most frequent cause of non-uniform service is the variation of chemistry on the tool surfaces. Small amounts of surface carburization or decarburization usually are unnoticed because they can be detected only by destructive testing.

Decarburization on working surfaces of tools causes a decrease of normal service life. And varying amounts of decarburization from tool to tool will cause variable decreases in service life.

Carburization, on the other hand, is not always harmful. Many tools last longer if a carburized case of the optimum depth and carbon content is present. This is true whether the carburized case is intentional, or whether it is accidentally and unknowingly present. The extent to which a carburized case either increases or decreases service life of tools must be determined by experience with the actual tools under consideration. It is therefore possible for tools with a "neutral" surface to be either better or poorer in service life than tools having a carburized case.

The surest way to provide uniform surface chemistry is to grind the tools adequately after the hardening operations. The only alternative is to be sure that "neutral" heat-treatment equipment is actually doing the expected job of providing unground hardened tools with neutral surfaces.

seconds. No separate mounting pad is required for this wheel.

Circle 615 on Readers' Service Card

Optical Polygon for High-Precision Indexing

A 360-sided optical polygon, Mili-chex Model MOX-3600, designed to provide users with a multiple-purpose tool for optically checking alignment and angular spacing in any multiple of full degrees, developed by Michigan

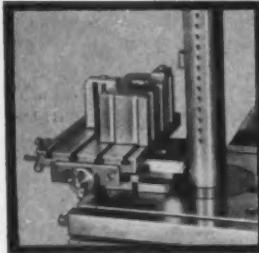
Tool Co., Detroit, Mich. This is a compact, high-precision indexing device with an optical mirror mounted on its rim. It is accurate to within 0.000012 inch at a 20-inch diameter. When used with an auto-collimator or similar optical sighting device, the optical polygon provides an accurate mirror surface which reflects the projected image of the sighting device's cross hairs. The amount of deviation between the reflected image and the graduated cross



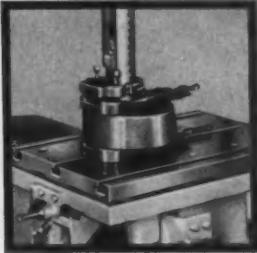
hair in the sighting device gives a geometric check on misalignment, parallelism, and angularity. The device can be used for inspection, manufacturing, or in the field.

Circle 616 on Readers' Service Card

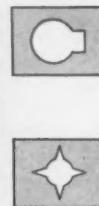
PERFORM SPECIAL PRODUCTION JOBS ON HYDRAULIC M&M KEYSEATER AND VERTICAL CUTTING MACHINE



Set-up for external cutting



Set-up for internal cutting



The new Mitts & Merrill Keyseater and Vertical Cutting Machine can be easily adapted to cutting splines, serrations and die profiles both internal and external, by adding simple fixtures.

With combination tilting table and index table, straight or tapered bores and accurately spaced multiple keyways or splines may be cut at any degree of the circle, with internal keyways up to 3" wide x 24" long.

Hydraulic drive gives smooth performance and faster machining; stroke and feed as well as tool relief are automatic, assuring exceptional accuracy.

Mechanical drive keyseaters also available. Send us prints of your cutting problems.

BUILDERS OF MACHINERY
SINCE 1854

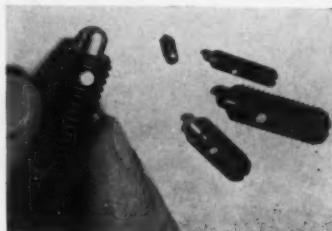
M&M KEYSEATERS AND
VERTICAL CUTTING MACHINES

112

MITTS & MERRILL • 64 Holden Street • SAGINAW, MICHIGAN

Vlier Spring Plunger with Nylok Self-Locking Feature

All models and sizes of spring plungers made by the Vlier Engineering Corporation, Los Angeles, Calif., are now available with the Nylok self-locking feature here illustrated at no extra cost.



These Vlier spring plungers are simple, spring-loaded devices which provide accurate, constant end pressures. They are widely used to position parts in dies, jigs, and fixtures, and in original-equipment applications where controlled end pressures are required. Four nose types are available: standard (round nose); hex nose, for greater ease of installation; Silvernose, which indicates special springs for use in highly repetitive die applications; and plastic nose, for use with soft materials such as brass and aluminum. Standard sizes vary from No. 6-32 by 17/32 inch to 1 inch, 8 threads per inch up to 2 1/4 inches long. End pres-

INCREASE ACCURACY... SAVE MONEY... IMPROVE YOUR PRODUCT...



AUTOMATIC TOOL CHANGER
— Edlund accessory automatically changes any one of 9 different tools in rapid 5-second change time.

with EDLUND-MATIC MODEL 2N NUMERICAL TAPE AND DIAL CONTROLLED DRILLING & TAPPING MACHINE

Save Time and Money

The Edlund-Matic eliminates expensive jigs and fixtures by using easy to prepare inexpensive standard 1" 8-channel tape. Floor-to-floor time per part is reduced — saving production time means saving money. Cut lead time of 4 to 6 weeks required for jigs and fixtures to few hours or less for tape preparation and save set-up time. Time saved results in direct dollar earnings.

Increase Accuracy

Increased accuracy means less scrap loss and less wasted production time. Edlund-Matic numerical tape

control positions the work and directs the drilling operation quicker and more accurately time after time and eliminates the possibility of human error once the operation has been programmed and checked. Employee fatigue is decreased and free time can be used profitably operating other machines.

Improve Your Product

You can be sure of greater uniformity of finished parts with less inspection required. Tapes can be pre-tested and machine accuracy certified. All this adds up to an improved product at lower cost.

EDLUND MACHINERY COMPANY

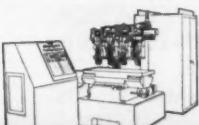
Specialists in Drilling Machine Engineering for over 40 Years

Edlund Representatives in Major Cities

Cortland, New York

Division of Harsco Corporation

Printed Circuit Board Drilling Machines



Tape Programmer



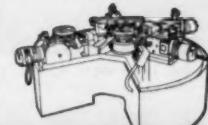
Infinitely Variable Speed
Machines



Gun Drilling Machines



Special Machines

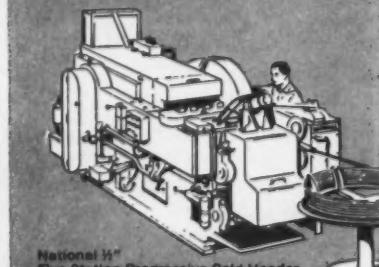




These important parts are cold-formed from wire, start to finish, in compact, efficient National Cold Headers.

Practically scrapless, all these parts achieve remarkable savings over past methods.

If you make odd-shaped parts, may we help you evaluate them for cold-forming from wire? Better yet, come to Tiffin, witness our demonstrations and let's discuss your work.



NATIONAL MACHINERY CO.
TIFFIN, OHIO, U.S.A.

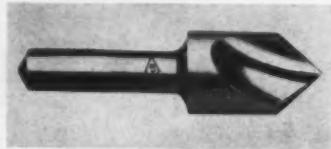
For more data, circle Item 312A

sures range from 1.5 to 68 pounds. All models can still be ordered without the Nylok feature, if desired.

Circle 617 on Readers' Service Card

Whitman & Barnes Countersink

A countersink of single-flute design has been added to the cutting-tool line of Whitman & Barnes, Plymouth, Mich. This high-speed tool is designed for machine use and light portable work. According to the manufacturer, it provides easy feeding, smooth burr-free holes, and chatterless operation over a wide



range of speeds and in a variety of materials. It is available in 1/4-, 3/8-, 1/2-, and 1-inch sizes, with included point angles of 60, 82, and 90 degrees.

Circle 618 on Readers' Service Card

Three-Jaw Self-Centering Positioner

Positioning device introduced by the Skinner-Horton Chuck Division of Skinner Precision Industries, Inc., New Britain, Conn. The standard size of this three-jaw,



self-centering positioner has a capacity of 3 to 40 inches, but larger and smaller sizes are available on special order. This equipment is described as a fast, accurate positioning device for such applications as welding and flame-hardening. Hardened steel jaws open and close at the turn of a wrench, and work is automatically centered. The holding device can be mounted on headstock, turntable,



...uses the
**WINSLO-MATIC
DRILL POINTER**

...where ultra-precision drilling is essential

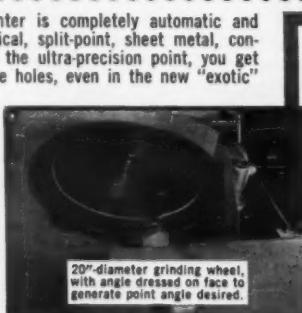
C F BRAUN & CO, leading manufacturer of heat exchangers for the process industries, uses the Model 100-A WINSLO-MATIC Drill Pointer for precision grinding of drills used in drilling deep holes for tubes in tube sheets. Complete satisfaction and extreme drilling uniformity is reported on this work. When the work calls for ultra-precision drilling . . . you can count on the fast, amazing WINSLO-MATIC Drill Pointer.

- The WINSLO-MATIC Drill Pointer is completely automatic and extremely fast. Produces helical, split-point, sheet metal, conventional points, etc. Due to the ultra-precision point, you get extremely true, close-tolerance holes, even in the new "exotic" alloys.

 - Handles drills from $1/32''$ to $1-1/2''$ diameters.
 - Point angles of 45° to 180° included.
 - Points are concentric within $.0002$.
 - Drills last up to twice as long.

20"-diameter grinding wheel, with angle dressed on face to generate point angle desired.

Write for



**Write for
free literature
and technical data**

Winslow PRODUCT ENGINEERING CORPORATION
47 ST. JOSEPH STREET • ARCADIA, CALIFORNIA

For more data, circle Item 212B on Readers' Service Card

MACHINERY, September, 1961

or positioner, and can be fitted with special jaws for unusual applications. It is sealed against dirt and abrasive materials and will stand up under rugged use.

Circle 619 on Readers' Service Card

Pipe Wrench

One of a line of malleable pipe wrenches announced by Armstrong Bros. Tool Co., Chicago, Ill. These pipe wrenches, carrying



the Armstrong Bros. trademark, are offered in a range of nine sizes having lengths of 6, 8, 10, 12, 14, 18, 24, 36, and 48 inches. Opening sizes range from 1/8 to 6 inches. Easy adjustment, drop-forged calibrated hook jaw, and double-action spring are features of this wrench. This line is offered in addition to the manufacturer's drop-forged line of pipe wrenches.

Circle 620 on Readers' Service Card

Buckeye Air-Powered Nutrunning and Screwdriving Tools

Recent addition to the fastening tools marketed by the Buckeye Tools Corporation, Dayton, Ohio, which now has twenty-four different models for air-powered nutrunning and screwdriving, includ-



ing several models equipped with a torque-control "one shot" clutch. This tool provides just a single pulse of torque for accurate control of the fastening operation, long life for the bit or socket, and elimination of damage caused by the bit slipping off the fastener and marring the work-piece. The model illustrated is the smallest

For top efficiency in tank cleaning

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



First choice in heavy-duty tank cleaning—hard-working Oakite "24"

Users everywhere agree that their best way to clean iron and steel parts is to tank-soak them in a hot solution of heavy-duty Oakite 24. This hard-working alkaline cleaner gets under the dirt layers and literally tears the soil from the surface. Despite excessive soil contamination of solution Oakite 24 maintains proper pH level and provides long, effective cleaning action.

Oakite 24 is but one of a wide range of alkaline tank-cleaning compounds. Others include medium and light duty oil and grease removers; self-emulsifying solvent cleaners specially designed for removing buffing compound residues, pigmented drawing compounds and other tenacious burned-on solid-particle dirts and smuts. Also available is a useful selection of materials for cleaning brass, copper, aluminum, magnesium, lead, tin and zinc.

Which is best for you? Only you and the Oakite man together can decide. It depends on your equipment, the parts you process, the next production step. Ask the Oakite man. From over 30 materials, you're sure to get the one cleaner that works most efficiently for you. Write for Bulletins. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite



For more data, circle this page number on Readers' Service Card.

and lightest tool made by Buckeye with a spring-loaded torque-control clutch. Its torque range (infinitely adjustable) and speed range (500 to 1800 rpm) make it particularly effective on No. 10 size screws and smaller. Two series are available with options of reversible (22F) and nonreversible (21F) operation, torque-control clutch, positive clutch, adjustable clutch, and straight-drive pistol grip or lever throttle, both with capacities up to No. 10 machine screws. Weights range from about

1 3/4 to 2 1/4 pounds, and lengths from 8 5/16 to 10 13/16 inches, inches, with an 11/16-inch offset on all models.

Circle 621 on Readers' Service Card

NEW PRODUCT BRIEFS . . .

ABRASIVE-BELT GRINDER with floor column mounting for spot-grinding applications. Provides 12 inches of

vertical motion by means of a foot treadle. Equipped with 3-inch wide by 132-inch long belt. Grinding & Polishing Machinery Corporation, Indianapolis, Ind.

Circle 622 on Readers' Service Card

"MULTI-WIRE" WELDER made for metal fabrication where more than one of the new semi-automatic welding processes are used. Equipped with six different welding guns. Carry-all truck facilitates transporting welder to work. Hobart Bros. Co., Troy, Ohio.

Circle 623 on Readers' Service Card

ZERO-MAX REVERSIBLE VARIABLE-SPEED DRIVES in new "400 Series" with reverse control by a separate knob or lever operated independently of the speed-control lever. Speeds range from 0 to 80 rpm to 0 to 1200 rpm, in either direction. Torque ratings from 3 to 450 inch-pounds. Zero-Max Co., Minneapolis, Minn.

Circle 624 on Readers' Service Card

MINIATURE WRENCHES of new nonmagnetic type comprising a new line with small open ends. Made of a beryllium-copper alloy material that provides the unique characteristics desired for assembly, repair, or maintenance of electronic equipment. Four sizes cover range from 3/16 to 7/16 inch. Overall length is only 3 1/2 inches. Beryllium Corporation, Reading, Pa.

Circle 625 on Readers' Service Card

ABRASIVE BELT HEADS with new floating feature for wet or dry grinding of flat, formed, or contoured parts, from roughing to finishing in one pass. Each head floats independently of the others, permitting simultaneous rough and finish grinding of a work-piece as it passes beneath the compact unit. Murray-Way Corporation, Birmingham, Mich.

Circle 626 on Readers' Service Card

MARQUARDT AUTOMATIC UNIVERSAL TESTING MACHINE for accurately determining physical properties of all types of materials. Available in 15,000-, 30,000-, or 60,000-pound capacities. Tests materials in tension, compression, bending, fatigue, creep, creep relaxation, and recovery. Marquardt Corporation, Van Nuys, Calif.

Circle 627 on Readers' Service Card

SELF-LUBRICATING BUSHINGS of plain, journal type capable of dynamic loads up to 25,000 psi and static

Logan / 14" LATHES

Accuracy is essential in a lathe. No one denies this.

Yet accuracy alone isn't enough. It must be sustained accuracy. This requires holding exact tolerances during all machining operations and throughout the lathe's productive life. The new Logan 14" swing lathes deliver this sustained accuracy. For example, these lathes have variable speed drive for precise turning speeds. The drive can be adjusted at anytime to any rpm (40-1400) while the lathe is running. You don't stop to shift belts! Also, the ball bearing spindle's 1 1/8" bore and 1 1/8" collet capacity will perform many jobs. But, perhaps, your best assurance of Logan accuracy is the thorough testing—from headstock to tailstock—of every lathe before shipment. Write for specification proof that Logan is your best dollar value in the lathe field.

accurate



MODEL 6510
\$1,775.00
F.O.B. FACTORY

LOGAN ENGINEERING CO., DEPT. K-801
4901 W. Lawrence Ave., Chicago 30, Ill.

Logan

yield loads to 50,000 psi at low rotational speed. Stainless-steel housings are employed, and the bushings have a plastic-alloy insert made of Dyflon. Bore sizes are from 1/4 to 3 inches. Southwest Products Co., Monrovia, Calif.

Circle 628 on Readers' Service Card

LINE OF TOTALLY ENCLOSED MOTORS of fan-cooled dust-tight type added to General Electric's family of Form G fractional-horsepower motors. Most have a welded-on base as required on machine tool applications. Ratings from 1/8 to 1 hp. General Electric Co., Schenectady, N. Y.

Circle 629 on Readers' Service Card

HIGH CURRENT-DENSITY SELENIUM RECTIFIER for electroplating and anodizing, battery charging, welding, and dynamic braking. Single cell ratings are from 200-milliamper half-wave convection-cooled to 33 amperes half-wave forced-air cooled. Cells connected in parallel give higher ratings. As an example, rectifier stacks for plating are available up to 5000 amperes. Westinghouse Electric Corporation, Pittsburgh, Pa.

Circle 630 on Readers' Service Card

AUTOMATIC-INDEXING TYPE TURRET DRILL HEAD built with two to five spindles for use on vertical, single-spindle drill press. All spindles of this ARBO-3 head are completely and quickly interchangeable. For drilling, capacity is 1/8 to 1 inch; and for tapping, 1/8 to 15/16 inch. Jersey Mfg. Co., Elizabeth, N. J.

Circle 631 on Readers' Service Card

NYLON "STEEL CORE" SCREWS having a natural-colored nylon outer threaded member with a hardened and cadmium-plated, completely insulated steel core. Available in styles for laboratory as well as general factory use in either small lots or large quantities. Machine Parts Supply Co., New York City.

Circle 632 on Readers' Service Card

POSSONS HOLD-BACK SAFETY GUARD for protecting operators of roller mills, calenders, shears and certain types of punch presses. Nylon wrist bands attached to adjustable straps prevent operator's hands from entering danger area. Positive Safety Mfg. Co., Cleveland, Ohio.

Circle 633 on Readers' Service Card

EXPANDED BED AUTO-PRESS of 16-ton capacity for high production of most metals, as well as lightweight

bulky materials, such as paper, plastics, and rubber. Speeds of 100 to 400 strokes per minute are standard. The bed is 11 1/2 by 15 inches. Feed width is 8 inches. Havar Mfg. Co., Minneapolis, Minn.

Circle 634 on Readers' Service Card

PORTABLE TENSILE TESTER weighing only 6 1/2 pounds, available in 50- and 100-pound load capacities. Designed for field and sales work, it provides accurate tensile-strength data for small gage wire, spot-weld coupons, rope, string, fishing line, and textile ma-

terials. Detroit Testing Machine Co., Detroit, Mich.

Circle 635 on Readers' Service Card

VERSATILE MACHINE BUILT FOR DRILLING and to eliminate need for jigs and fixtures for normal drilling, tapping, and boring operations. Incorporates "BLOX" positioning method with push-button selective control, rotary index sequencing, and vertical or horizontal programming. Provided with both electrical automatic cycling and complete unit positioning, and optional

MODERNAIR USES BURGMMASTER TURRET DRILL AND RAPID POSITIONING TABLE *To Save 60% Tooling Costs!*



Reduce tooling time by over 80%

Save 8 hours per part production time

RAPID POSITIONING TABLE Speeds 85 Drill, Tap and Ream Operations Per Part

When Modernair Corporation, San Leandro, California had to machine 85 different operations in a lot of 2024 aluminum valve bodies, they selected a Burgmaster Model 2B, 6-spindle turret drill equipped with a Burgmaster rapid positioning table. This Burgmaster combination permitted holding-fixture costs to be cut from \$266

to \$90.00, tooling time from 2 weeks to 2 days, and production time savings of 8 hours of labor per valve body. Ream tolerances were held to a $\pm .0005$ with a RMS-18 finish and hole locations were held to a $\pm .002$. Another reason you should get the facts on Burgmaster.

SEND FOR LITERATURE



selective manual positioning. Swift Ohio Corporation, Kenton, Ohio.

Circle 636 on Readers' Service Card

ALTERNATING-CURRENT WELDING POWER SUPPLY UNIT of compact design, featuring a half-cycle timing switch for use with single or dual-synchronous timers. When used with single or dual timers, the unit has a 0.5- to 10-cycle timing range and a 6- to 30-cycle timing range with the heat program timer. Raytheon Co., Waltham, Mass.

Circle 637 on Readers' Service Card

CONTINUOUS-DRAW FURNACE for gas-fired or electric operation. Adapted for the continuous drawing of ferrous and nonferrous metals. Built in nine standard sizes of heating chambers. Production ranges from 100 to 1000 pounds per hour. Maximum temperature is 1250 degrees F. Sunbeam Equipment Corporation, Meadville, Pa.

Circle 638 on Readers' Service Card

PANTO-ENGRAVER WITH PNEUMATIC DEPTH CONTROL designed for diamond-drag pantographic marking on hardened steel, tungsten carbide, and all non-ferrous metals. Economi-

cally marks sizes, serial, part, or code numbers on machine, automotive, or aircraft engine parts where other methods are impractical or not permissible. H. P. Preis Engraving Machine Co., Hillside, N. J.

Circle 639 on Readers' Service Card

CUTTING ATTACHMENT FOR WELDING TORCH that employs medium pressure for cuts up to 6 inches. It can be used with any one of three Harris welding torches. Five cutting tips are available for use with the attachments for special applications. Harris Calorific Co., Cleveland, Ohio.

Circle 640 on Readers' Service Card

HIGH-SPEED PRECISION ROLL FEED for coil and strip stock feeding at rates of over 3000 ipm. Employs stress analysis to calculate correct roll pressures and eliminate stock slippage or distortion under high-speed feeding conditions. Self-adjusting for variations in stock thickness. Strokes up to 6 inches are available. Ferguson Machine Co., St. Louis, Mo.

Circle 641 on Readers' Service Card

COIL SPRINGS of expanded line totaling more than 1500 sizes, including precision compression and extension types, are available for shipment within twenty-four hours of receipt of order. Easy-to-use SPEC spring catalogue enables users to quickly match required outside diameter, wire size, length, and other specifications. Associated Spring Corporation, Bristol, Conn.

Circle 642 on Readers' Service Card

ROCKWELL HARDNESS-TESTING MACHINE of horizontal type, designed for easy loading and operating and to insure accurate, efficient testing of large-size pieces. The head swings 180 degrees to allow accurate checking of the outside, pitch, and root diameters of gears. Can be equipped to check large inside diameters. Clark Instrument, Inc., Dearborn, Mich.

Circle 643 on Readers' Service Card

TUBE BENDERS available in six sizes for bending soft or hard copper, aluminum, and certain sizes of stainless-steel tubing, as well as brass tubing. The six benders accommodate tubing ranging from 3/16- to 1/2-inch outside diameter. Facilitate working with tubing already installed or where access is difficult. Ridge Tool Co., Elyria, Ohio.

Circle 644 on Readers' Service Card

O-KNI-CO TUNGSTEN-CARBIDE TIPPED KNIVES for high-speed, high-production cutting and shearing work.

Here they are—the *Buck* chucks that solve most work-holding problems



Left to right:

1. Aluminum power chuck with gibbed keyways
2. Dust proof chuck
3. Steel Power chuck, Serrated Jaws
4. Independent chuck
5. Steel Power chuck, American Standard
6. 6 jaw Ajust-Tru

Ready to cut your machining costs

You start saving—on production or in the tool room—the day you put Buck Ajust-Tru chucks to work.

MANUAL chucks adjust for dead true precision in a minute—guarantee .0005" precision chucking duplicate parts.

POWER chucks—steel or aluminum body, regular or serrated jaws—guarantee precision within .001" and provide many other exclusive operating savings.

It's the unique, patented Buck Ajust-Tru principle that makes Buck chucks so different—at no price premium. It'll be well worth it to get full details.

NEW Catalog 61 ready—write for it.

BUCK TOOL COMPANY

920 SCHIPPERS LANE • KALAMAZOO, MICH.

Effectively resist a high degree of abrasion and maintain cutting accuracy over long runs. Cut all classes of iron, steel, and nonferrous alloys. Also used for high-production slicing of thin sheets of plastics, formica, rubber synthetics, and other nonmetallics. Line includes shear blades, bed knives, scraper blades, fly knives, and many other specials. Ohio Knife Co., Cincinnati, Ohio.

Circle 645 on Readers' Service Card

PARALLEL STRAIGHTEDGE of new type with built-in level, available in both lightweight aluminum and standard semisteel. Serves dual purpose of checking both the levelness of a machine bed and its accuracy simultaneously. All working surfaces on both types are precision-ground flat and parallel to within 0.0005 inch over-all. Challenge Machinery Co., Grand Haven, Mich.

Circle 646 on Readers' Service Card

OILGEAR SOLENOID-PILOT-OPERATED CONTROL VALVES of heavy-duty type for pressure up to 3000 psi (some 5000 psi), available in two-, three-, and four-way directional models for eight pipe sizes ranging from 1/2 to 3 inches. All valves feature new Oilgear solenoid-pilot "operator" valve. Oilgear Co., Milwaukee, Wis.

Circle 647 on Readers' Service Card

KINESONIC MAGNETIC-TAPE CLEANER using a transducer to obtain both sonic and ultrasonic cleaning of tape. Reduces tape errors and machine stoppages by cleaning loose oxide, base chips, and dirt from tape. This is accomplished by producing high-energy sonic and ultrasonic cavitation directly at the tape edges and surface. General Kinetics, Inc., Arlington, Va.

Circle 648 on Readers' Service Card

GUN TYPE AUTOMATIC FEED-ER-DRIVER for feeding and driving socket set-screws. Compact, portable machine that can be moved from one location to another. Gun type driver will automatically receive and drive screws more than 25 feet from the machine. Bristol Co., Waterbury, Conn.

Circle 649 on Readers' Service Card

WALTON TAP EXTRACTORS designed to fit taps for "Helical Coil" wire screw thread inserts. This new series of twenty-two tap extractors includes sizes to fit all standard Helical Coil "S.T.I." taps from No. 4 through 5/8-inch in two-, three-, and four-fluted styles. Walton Co., Hartford, Conn.

Circle 650 on Readers' Service Card

METALIZING WIRE AND POWDERS of high purity, including molybdenum wire and a line of metal powders, oxides, and carbides, for spray metallizing and plasma-arc applications. High-purity tungsten, tantalum, columbium, hafnium, and zirconium metal powders, carbides, and oxides round out the line. Wah Chang Corporation, New York City.

Circle 651 on Readers' Service Card

COMPACTING PROCESS utilizing the "Vibrajust Shockwave" for the fabrication of powdered metal, ceramic,

and cermet components. This process is said to enable far greater preform densities to be obtained than previously achieved with conventional compression apparatus. Branford Co., New Britain, Conn.

Circle 652 on Readers' Service Card

TOOLMAKER'S VISE hardened and precision-ground to parallelism of 0.0002 inch. Features extra-large jaw opening of 6 inches and a jaw width of 3 inches. Removable hardened and ground jaws with inside and outside jaw positions increase versatility. Bald Eagle Products Co., St. Paul, Minn.

Circle 653 on Readers' Service Card

HAMILTON[®] PORTELVATOR[®]

THE HANDY HAMILTON PORTABLE ELEVATING TABLE

2968



use it with confidence!

If you think

that the various makes of elevating tables are "all-pretty-much-alike", that a device so simple allows scant room for important points of superiority, then, without fail, you must have a copy of our new, FREE Portelvator Bulletin No. P/2968. Ask for it by name. Ask for it today!

THE HAMILTON TOOL COMPANY

834 SOUTH NINTH STREET

HAMILTON, OHIO

NEWS

of the Industry

Isabel Shamlian

California

GISHOLT MACHINE CO., Madison, Wis., has announced the assignment of EARL R. CARPENTER as field service engineer for the Los Angeles, Calif., area. Also announced was the appointment of DARLING-CORSE MACHINE CO., INC., San Francisco, as a representative in that area. Darling-Corse will handle all sales of Gisholt Masterline manual and automatic turret lathes, single-spindle automatic lathes, Cri-Dan automatic threading lathes, superfinishes, and balancing machines.

CARPENTER STEEL CO., Reading, Pa., has appointed ROBERT W. TITGEMEYER and KENNETH C. LARGENT district managers of the Los Angeles and San Francisco, Calif., areas, respectively. In his new position, Mr. Titgemeyer will direct sales in the Los Angeles territory, San Diego, and the state of Arizona. Mr. Largent will be responsible for sales activities in northern California, Oregon, Utah, Washington, and Nevada.

LANCE P. JOHNSON has been made product exploitation director for HUGHES AIRCRAFT CO., Culver City, Calif. In addition, he will retain his position as manager of the industrial systems division and also manage a newly created electronics products division of the components group, both under I. F. RICHARDSON, vice-president and group executive. Mr. Johnson will make his headquarters at the Hughes Newport Beach, Calif., plant.

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, has established a West Coast TRAMRAIL DIVISION with plant at 8435 Corvette St., Los Angeles, Calif. The plant will provide service for customers of overhead materials-handling equipment in the western states. KARL PAMER is manager of the division.

Illinois, Indiana, and Ohio

VICKERS INCORPORATED, division of SPERRY RAND CORPORATION, De-

troit, Mich., has made ROY GOLZE midwestern regional manager in the Industrial Sales Department, Machinery Hydraulics Division. Located in the firm's Chicago, Ill., office, he will direct sales activities in the Chicago, Rockford, and St. Louis areas. Replacing Mr. Golze as district manager in Philadelphia, Pa., is ROBERT G. WHITE. Prior to his new assignment, Mr. White served as an application engineer in the Vickers Detroit office.

G. M. DIEHL MACHINE WORKS, INC., Wabash, Ind., has appointed CHARLES W. TUTTLE president, to



Charles W. Tuttle, newly appointed president of G. M. Diehl Machine Works, Inc.

succeed JOHN A. COLLINGE, who resigns as president of both Diehl and INDIANA-MACKAY FOUNDRY CORPORATION, Muncie, effective September 1. Mr. Tuttle has served Diehl as executive vice-president since 1958, and was previously vice-president and general manager of Indiana-Mackay Foundry Corporation.

GLENFORD M. SHIBLEY has been named sales manager, Brush Division, by OSBORN MFG. CO., Cleveland, Ohio. Mr. Shibley was previously manager, industrial distribution, for the company.



Carl E. Anderson, elected president and chief executive officer of E. W. Bliss Co.

CARL E. ANDERSON has been elected president and chief executive officer of E. W. BLISS CO., Canton, Ohio. Mr. Anderson was previously the director of general management consultation for EBASCO SERVICES INC. He will make his headquarters in Canton.

GISHOLT MACHINE CO., MASTERGLAS PLASTICS DIVISION, Madison, Wis., has appointed MISAMORE-DAVIS CO., Cleveland, Ohio, as its exclusive sales representative for northern Ohio.

Michigan and Wisconsin

Two new sales representatives—one in the United States, the other overseas—have been appointed by DETROIT BROACH & MACHINE CO., Rochester, Mich. G. W. BRUNTON & SON INC., Buffalo, N. Y., will represent Detroit Broach on an exclusive basis, covering the entire Buffalo territory and adjacent counties. Overseas, RUECKERMANN LTD., Tokyo, Japan, will represent the company throughout that country. Both organizations will handle Detroit Broach's entire line of broaching machines and cutting tools; straightening, forming, riveting, swaging, and



NOW... CONTINUOUSLY VARIABLE RANGE OF SPINDLE SPEEDS WITH CONSTANT HORSEPOWER THROUGHOUT

Now, by simply pressing a button until the desired speed is indicated on the direct-reading tachometer, you can select any spindle speed from 43 to 3500 RPM.

The new Micro-Turn features exclusive Nebel coaxial headstock spindle design plus mechanical beltless type variator drive unit (5 HP), which delivers constant horsepower throughout the entire range and maintains drive output speed within two-tenths of one percent. This assures maximum torque at low speeds for heavy cutting and ultra fine finish at highest speeds, with supreme balance and minimum vibration. Built-in positive torque responsive mechanism prevents slippage under starting or shock loads.

Other features include:

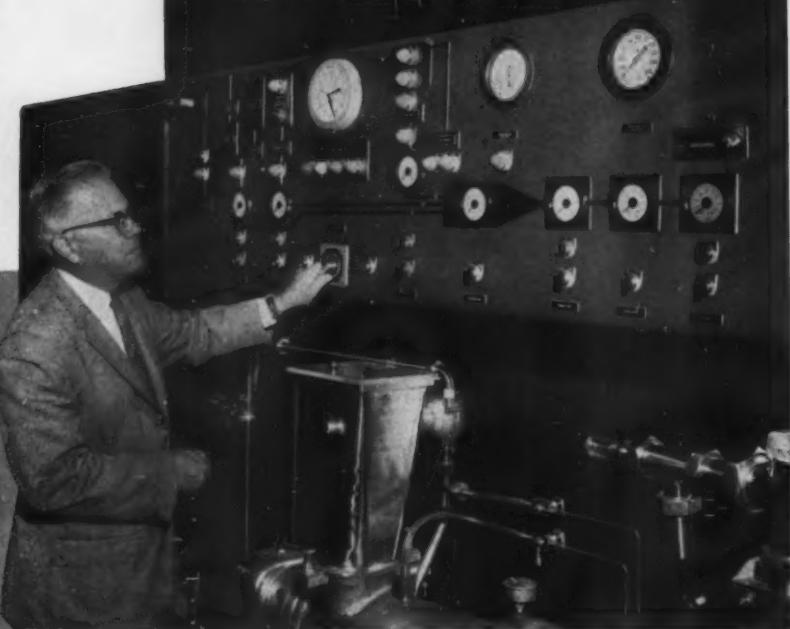
- exclusive feed converter unit, located in apron, providing simple conversion from standard to optional feed ranges without affecting standard thread ranges;
- double-wall, one-piece totally enclosed apron;
- fail-safe pressure lubrication to headstock, gear box and end gearing;
- pressure lubrication to carriage and cross slide ways provided by pump located in apron; one-shot plunger to lubricate cross slide ways when carriage is stationary;
- choice of manual or automatic coolant operation.

For the complete, illustrated story on the revolutionary MICRO-TURN, write today for your copy of Bulletin No. 222. Nebel Machine Tool Corporation, Lathe Division, 3410 Central Parkway, Cincinnati 25, Ohio.

NEBEL
MICRO-TURN
HIGH SPEED PRECISION LATHE

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EQUIPMENT BUILT BY AMF'S
UNION MACHINERY DIVISION USES
THESE VICKERS COMPONENTS

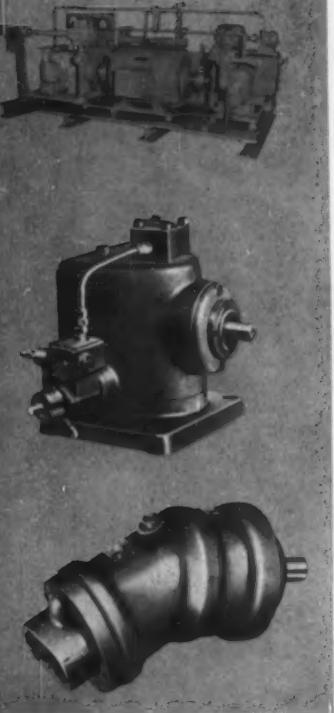


CUSTOM POWER PACKAGE—A double-ended 60 hp electric drive motor is the prime mover for the two main hydraulic drives—one powering the developer (30 to 50 hp), the other driving the incorporator (5 to 10 hp). Vickers also supplies auxiliary control valving as part of the complete package. For more details on customized or standard power packages contact your Vickers application engineer.

PISTON PUMPS—AMF's application employs variable-displacement pumps having electrical remote volume control. Industry's broadest standard line includes models with flows to 180 gpm and pressures to 5000 psi, plus a wide variety of controls. For additional information write today for Bulletins 61-81, 61-84 and Catalog 5001C.

HYDRAULIC MOTORS—This fixed-displacement motor is only one of a complete line that includes models for variable horsepower (constant torque) or constant horsepower (variable torque) output characteristics in ratings from fractional to hundreds of hp.

Vickers adjustable-speed hydrostatic drives offer many unique advantages and economies—especially for applications where there are problems of space, weight, fast acceleration, infinite speed or tension control, sudden braking or reversing, hazardous or corrosive surroundings.



VICKERS[®]
VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

assembly presses; as well as the firm's newly acquired hydraulic tracer conversion unit for lathes.

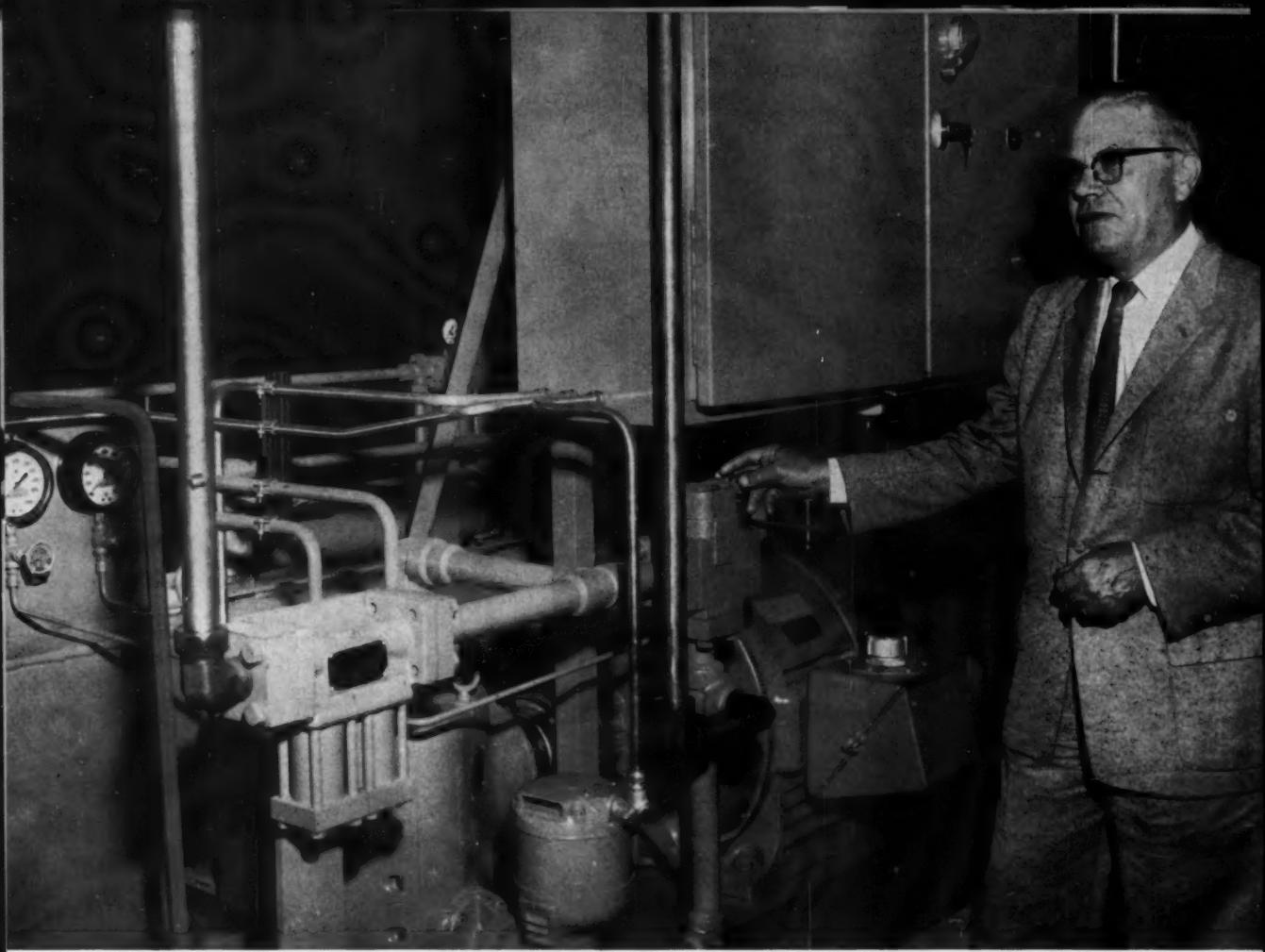
DEVLIEG MACHINE CO., Royal Oak, Mich., has announced the completion of a 20,000-square-foot addition to its plant at 14-Mile Road and Fair St.—three years after building a new 130,000-square-foot plant which, at the time, doubled the firm's floor space.

NATIONAL AUTOMATIC TOOL CO., INC., Richmond, Ind., has appointed WING & JABAAY, Grand Rapids, Mich., sales representative for the western Michigan area. The firm will handle the complete line of Natco production drilling, boring, facing, milling, and tapping machines, as well as the complete line of Natco/Jes-Cal production honing machines and associated equipment. They have also been authorized to handle the Natco-Delapena line of induction heat-treating equipment. PENINSULAR MACHINERY CO., Detroit, will continue to represent Natco for its line of plastic injection molding machines,

MITTS & MERRILL, INC., Saginaw, Mich., has appointed GORDON V. ANDERSON general manager and JACK RANOUS sales manager. Mr. Anderson, sales manager of the company for the past four years, has been engaged in national sales of machine tools since 1946. Mr. Ranous has been chief engineer of the company since 1956.

FRED G. CROSBY, Jr., has been named regional branch manager for the Detroit, Mich., territory of KEARNEY & TRECKER CORPORATION, Milwaukee, Wis. Mr. Crosby was previously assistant branch manager.

MICROMATIC HONE CORPORATION, Detroit, Mich., has announced that DON S. CONNOR, president and general manager of the firm since 1957, and a member of the board of directors for the past seventeen years, has retired because of ill health. WILLIAM J. PINKERTON, formerly executive vice-president and assistant general manager, succeeds Mr Connor as president and general manager. RAY W. GAUSS has been made executive vice-president and treasurer. He previously was controller and assistant treasurer. ROBERT J. DIEKMAN was named secretary. Mr. Pinkerton joined Micromatic Hone in 1942 as personnel director and for several years handled both personnel and advertising responsibilities. He was named vice-president of manufacturing in 1952,



MELBURN B. HANCOCK, CHIEF ENGINEER, AMF'S UNION MACHINERY DIV., SAYS:

"Hydraulics give us compactness, easy clean-up..."

"... accurate speed control, and freedom from noise and vibration in the operating area. Because the use of adjustable speed hydrostatic transmissions on bread machinery was, in a sense, a pioneering effort, we found it essential and helpful to work closely with Vickers engineers in developing a completely workable system that offered our customers advantages unobtainable elsewhere.

"Our speed control must be accurate since any speed variation may degrade the end product. This speed control is required from about one-half speed to maximum speed of the equipment. Also, the system must be extremely flexible since operating speeds vary from time to time depending on characteristics of the raw material.

"With hydraulics we are able to reduce the overall size of the equipment for the production area where space is at a premium. Combined with other space saving design features, this machine is smaller than would otherwise be possible.

"Last . . . but by no means least in the food industry . . . is the ease with which the machine can be cleaned

(firehoses are usually used to wash down equipment) because hydraulic units are sealed from external moisture, etc. This is a daily operation on breadmaking machinery and is a major advantage to commercial bakeries."

Whether your requirement is for a refinement to existing methods of applying hydraulics or a completely new approach to providing power and control to machinery, Vickers design and application engineers are ready to work with you to effect the most efficient and economical solution. See facing page for more details about components and systems used by Union Machinery Division, American Machine & Foundry Co., and the overall Vickers line.

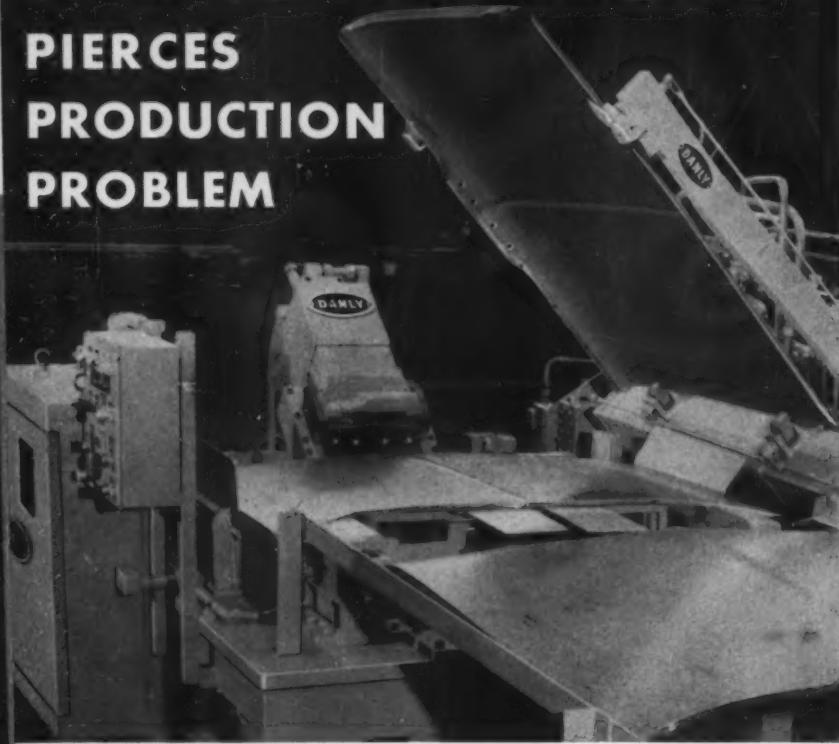
VICKERS

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DANLY

IMAGINATION

PIERCES
PRODUCTION
PROBLEM



This **Hydraulic Piercing and Turnover Unit**, designed and built by Danly for a major automobile manufacturer, automatically pierces ornament mounting holes in hoods as they come off the forming press. And it handles 600 hoods per hour! Then it turns them over for the next operation. Versatile! Practical, too—because it eliminates the need of a press for piercing and a separate turnover unit. Typical of the Danly engineering that applies hydraulics and imagination to speed production and cut costs.

Danly's complete line of **Hydraulic Platen Presses** and hydraulic cylinders offers you the tools to solve virtually any compression molding, bonding, laminating, trimming, extruding or piercing problem in processing metal, plastics, or rubber. They're precision units with accurately machined platen faces, positive parallel platen closure, uniform pressure distribution and extra, rigid strength. And Danly's versatile engineering adapts these tools to *your specific needs*.



HYDRAULIC PRESS CATALOG
shows all the features, sizes, adaptations—all the reasons why you should invest in a Danly. Write for your copy.



Mechanical Presses, Die Sets, Die-makers' Supplies, Hydraulic Metalworking Equipment

DANLY

DANLY MACHINE SPECIALTIES, INC., 2100 South Laramie Ave., Chicago 50, Ill.

became administrative vice-president in 1957, and was elected executive vice-president and assistant general manager and a director in 1959.



William J. Pinkerton, president and general manager of Micromatic Hone Corporation

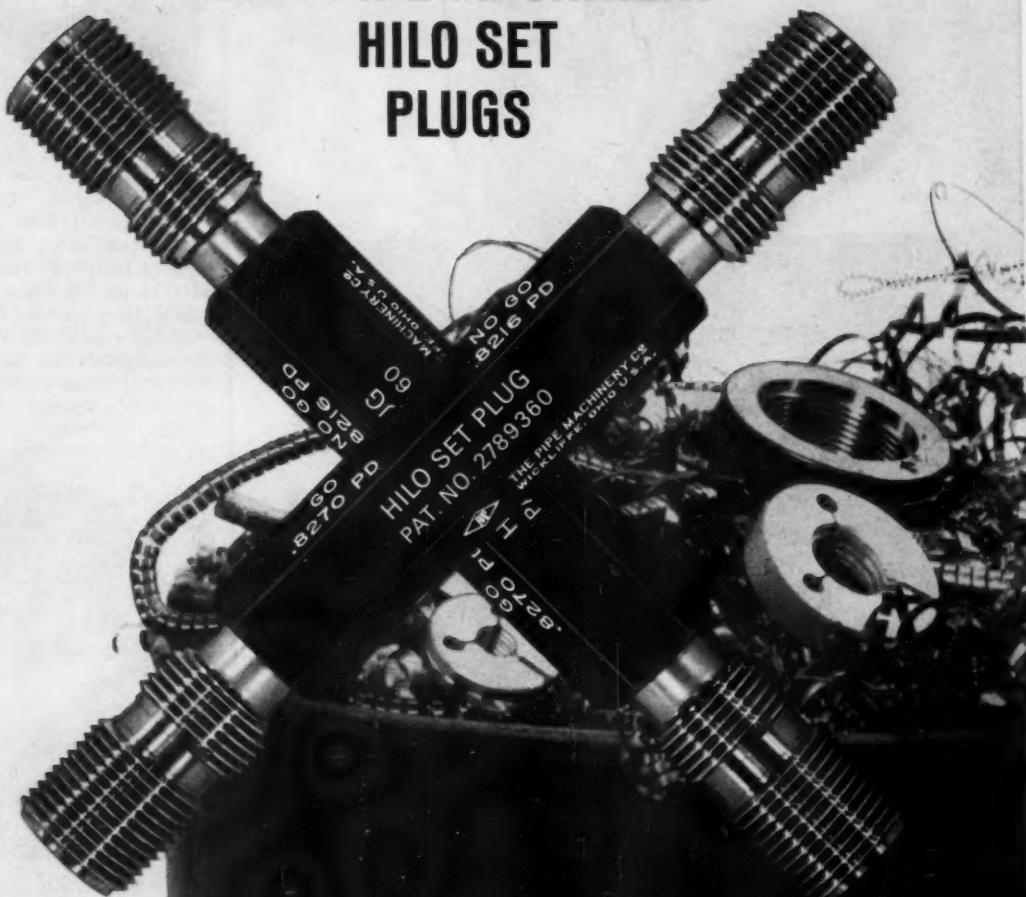


Ray W. Gauss, executive vice-president and treasurer, Micromatic Hone Corporation



Robert J. Diekman, new secretary of Micromatic Hone Corporation

**STOP
NEEDLESS RING GAGE
SCRAPPING
WITH PIPE MACHINERY
HILO SET
PLUGS**



Are you discarding thread ring gages that still have plenty of wear life in them?

With Pipe Machinery Hilo Setting Plug Gages you can be certain you are not guilty of such wasteful, untimely scrapping. You utilize every bit of the tolerance to which you're entitled — reject a ring only when it is definitely out of limits.

For complete information on new, more accurate Pipe Machinery Hilo Setting Plug Gages, write us on your company letterhead today.



THE PIPE MACHINERY COMPANY 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

MACHINERY, September, 1961

For more data, circle this page number on Readers Service Card.

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PRODUCTION PRECISION

GRAND RAPIDS MODEL F PRODUCTION GRINDER



MODEL F HYDRAULIC FEED SURFACE GRINDER, a production type with cross sliding head, built in sizes ranging from 12" x 18" x 48" to 30" x 25" x 120". A heavy, powerful grinder with maximum table speeds of 150' per minute. Motor mounted directly on grinding wheel spindle to assure that full power is transmitted directly to wheel. The machine illustrated is equipped with automatic downfeed which can be set to remove stock in increments from .0001 to .001 per table reversal.

New literature gives all the facts. Write for your copy.

GALLMEYER & LIVINGSTON CO., 305 Straight Ave., S. W., Grand Rapids, Mich.



Paul N. Gustafson, manager of Cone-Drive Gears Division of Michigan Tool Co.

MICHIGAN TOOL CO., Detroit, Mich., has announced the appointment of PAUL N. GUSTAFSON as manager of its CONE-DRIVE GEARS DIVISION. He succeeds FRED E. BIRTCHE, who has retired. Also announced is the advancement of GEORGE A. SCHIMMIN from assistant sales manager to sales manager of the division.



C. Paul Porterfield, newly named director of sales for Elox Corporation of Michigan

C. PAUL PORTERFIELD has been named director of sales for ELOX CORPORATION OF MICHIGAN, Troy,

GRAND RAPIDS

Mich. He will direct national and international sales and administrate Elox's expanded program for licenses in England, France, Germany, Switzerland, Austria, Italy, and Spain.

MICROBORE DIVISION of DeVlieg MACHINE Co., Royal Oak, Mich., has appointed T. J. KREUZER Co., Milwaukee, Wis., as its exclusive representative for the sale of precision cutting tools. Mr. Kreuzer, head of the Wisconsin firm, will handle sales personally in the southern and eastern sections of the state assigned to the company.

Nebraska and Oklahoma

ELMER KRASKE has been named the exclusive representative in the Omaha, Neb., sales district for the CLEVELAND WORM & GEAR and FARVAL DIVISIONS of EATON MFG. Co., Cleveland, Ohio. The Omaha territory covers portions of the states of Iowa and Nebraska.

The appointment of D. E. LIGON to the position of field engineer serving the southwestern area has been announced by DENISON ENGINEERING DIVISION, AMERICAN BRAKE SHOE Co., Columbus, Ohio. Mr. Ligon will be responsible for the sales of Denison hydraulic pumps, motors, and controls to engineering and manufacturing firms in the area covered by the states of Arkansas, Colorado, Kansas, and Oklahoma. He will make his headquarters at the Denison Tulsa office, 208 Wright Annex, 3rd and Cheyenne, Tulsa, Okla.

New England

AMERTOOL SERVICES, INC., has elected HOWARD A. FINCH, manager of marketing for JONES & LAMSON MACHINE Co., Springfield, Vt., president of the organization. Also, J. A. GERARD, vice-president, CONE AUTOMATIC MACHINE CO., INC., Windsor, Vt., was elected vice-president.

CAPEWELL MFG. Co., Hartford, Conn., has elected PHILIP C. SAYRES president of the company, effective October 1. Mr. Sayres is at pres-

TOOLROOM PRECISION

GRAND RAPIDS MODEL 1230 O.D. & I.D. GRINDER



NO. 1230 HYDRAULIC FEED O.D. AND I.D. GRINDER meets the needs of users requiring a machine that does both internal and cylindrical grinding. It is a rugged, precision tool capable of taking rough cuts as well as producing the finest finish. Longitudinal table movement is controlled by valve or by hand wheel. Cross feed is actuated by hand wheel. Magnetic starters are furnished for each motor.



Write for copy of latest literature with complete details.

GALLMEYER & LIVINGSTON CO., 305 Straight Ave., S. W., Grand Rapids, Mich.

GRINDERS





Winter Brothers Acme Taps are the ideal tools for generating screw threads that transmit motion, particularly where heavy loads or precise positioning are important factors.

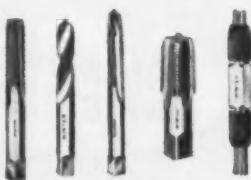
Famous Winter "Balanced Action" performance and superior quality are built-in features of every Acme Tap. Unequalled experience in all phases of tapping is your assurance that Winter will recommend the minimum number of Acme Taps to give you longer tool life and lower cost-per-hole. The result will be maximum economy on all of your Acme threading operations.

The skilled technical assistance of Winter Brothers engineering staff is available through your local distributor. Call him today.

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
CHICAGO • DALLAS • SAN FRANCISCO • LOS ANGELES



Choose from
Winter's Wide Line of
Taps, Dies and Gages

CALL YOUR WINTER DISTRIBUTOR



Philip C. Sayres, newly elected president of Capewell Mfg. Co.

ent administrative vice-president of RICHARDSON-MERRELL INC., formerly VICK CHEMICAL, and has held other important posts in the manufacturing field.

New York and New Jersey

GISHOLT MACHINE CO., Madison, Wis., has made SYRACUSE SUPPLY CO., Syracuse, N. Y., its representative in the Buffalo area. Syracuse Supply Co. maintains branch offices in Buffalo and Rochester, in addition to its home office. Each one will be responsible for contact, quotations, sales, and service follow-up in its respective area with over-all control exercised by R. H. FORSTER, sales manager, from the home office. All three offices will be assisted by WILLIAM L. NYBERG, district manager of Gisholt's office in Pittsburgh, Pa.

DR. THOMAS H. MANNINEN has been appointed technical assistant to the president of AIR REDUCTION CHEMICAL & CARBIDE CO., a division of AIR REDUCTION CO., INC., New York City. As an advisor to G. R. MILNE, the division's president, Dr. Manninen is responsible for reviewing and evaluating plans for new plants, plant expansions, and plant improvements.

RUSSELL, BURDSALL & WARD BOLT AND NUT CO., Port Chester, N. Y., has established a Sintered Products Division for the manufacture of powder-metal parts. J. M. DILL is manager of the division.

RICHARD W. AGNELLO has been made a regional sales manager by F. Jos. LAMB CO., Detroit, Mich., representing the firm in western New York and southeast Canada. The new sales office will be located in Buffalo.



Bernard J. Mezger, appointed manager of technical coordination for Gleason Works

The appointment of BERNARD J. MEZGER as manager of technical coordination has been announced by GLEASON WORKS, Rochester, N. Y. Mr. Mezger, formerly a research and development manager with the RADIO CORPORATION OF AMERICA and CURTISS-WRIGHT CORPORATION, will be responsible for the coordination of all advanced engineering activities at Gleason Works.

DIEHL MFG. CO., Somerville, N. J., has named WILLIAM T. VOLKHARDT market analyst. Mr. Volkhardt's principal duties will be market research for the company's fan, servo-motor, numerical-control, and military product lines. Also announced were three appointments to the firm's Numerical Control Department: HORACE S. DALEY has been made manager; JOHN J. CALLAHAN, sales engineer; and GEORGE SCHMITT, service engineer.

GISHOLT MACHINE CO., Madison, Wis., has announced the appointment of CINROCK MACHINERY, INC., Clifton, N. J. as its representative in the Clifton area. Cinrock will handle all sales of Gisholt Masterline machines, and will be assisted by WILLIAM L. NYBERG, district manager of Gisholt's direct office in Pittsburgh, Pa., and GEORGE T. MORRIS from the home office in Madison.

Pennsylvania and West Virginia

TEXTILE MACHINE WORKS, Reading, Pa., has announced the establishment of two new positions and the following promotions. VINCENT SCALESE has been promoted from manufacturing engineering manager to production manager of Textile's

NATIONAL
MILLING
CUTTERS
for peak efficiency on
every milling operation



National

For every milling application, there's a job-proved National Cutter to give you more efficient operation and provide the tool life and production rate you require.

Your National Distributor, backed by the most competent engineering staff and the best testing facilities in the industry, has a truly complete line from which to select and recommend the right cutter for your specific needs.

All National Milling Cutters, both high speed steel and carbide tipped, are subject to highest quality control standards, from raw material selection to final inspection.

Whatever your particular milling problem, be sure to consult your National Distributor. You'll appreciate the many 'plus' values offered only by National.

NATIONAL TWIST DRILL & TOOL COMPANY
Rochester, Michigan, U.S.A.

DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
CHICAGO • DALLAS • SAN FRANCISCO • LOS ANGELES

*Just One of
National's Parade of
Plus Products

CALL YOUR NATIONAL DISTRIBUTOR



How to use FLUID POWER

✓ efficiently
✓ economically
is as easy as . . .



when you specify



SERIES



Standard Cylinders

AIR or OIL

Without Modification

Save money with S-P's complete line; rated 200 psi air, 500 psi oil or water; 23 mounting types; 11 bore sizes— $1\frac{1}{2}$ " thru 14"; see Catalog 110C.



SERIES



HIGH PRESSURE Hydraulic Cylinders

Get smoother, more precise power; ruggedly built, interchangeable; 2000 psi (3000 psi non-shock); 12 bore sizes— $1\frac{1}{8}$ " thru 12"; get Catalog 117.



SERIES



Air-Oil BOOSTERS

Save money, save space; boost 80 psi line air to 3000 psi hydraulic power with no added power consumption, no maintenance; see Catalog 116.

FREE Engineering
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machine-shop operations. He will have responsibility for and direction of planning and stores, scheduling, and traffic. RICHARD C. BODEY succeeds him as manufacturing engineering manager, while RICHARD L. HORNBERGER will be assistant manager. JOHN W. WARREN is the new operations manager—foundry, with responsibility for and direction of all manufacturing operations within the Textile foundry.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has appointed WILLIAM R. MOGG assistant director of metallurgy-technical services. In his new position, Mr. Mogg will be responsible for planning and evaluation of technical aspects of product development activities and for providing technical services to the company's product divisions and customers. WILLIAM H. McCORMICK has been made company metallurgical engineer, representing the firm from the technical standpoint with government, technical and trade groups, and industrial contractors and subcontractors.

CARPENTER STEEL CO., Reading, Pa., has named ROBERT C. MEILI assistant manager, stainless-steel

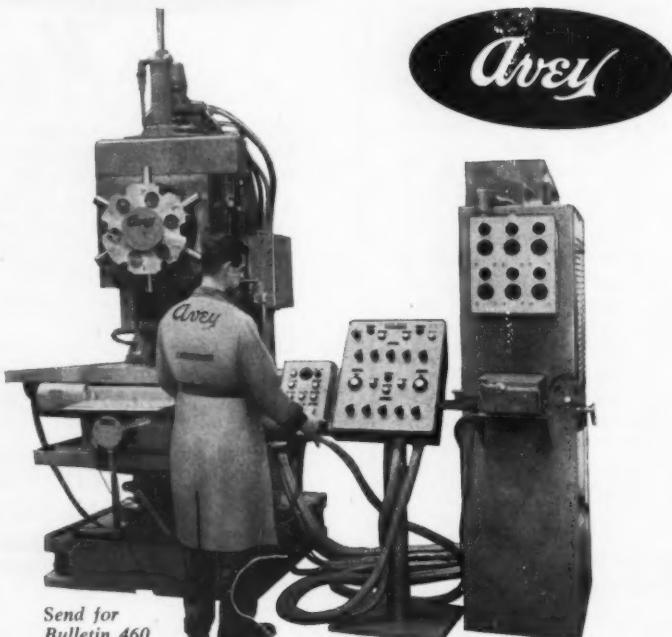
sales. In his new capacity, Mr. Meili will assist with sales and distribution of stainless steel directly from the mill and the Carpenter warehouse system. W. KENT KISE, JR., has been promoted from assistant manager to manager of electronic alloy sales.

BROWN & ZORTMAN MACHINERY Co., Pittsburgh, Pa., has been appointed by GISHOLT MACHINE Co., Madison, Wis., as its representative in the Pittsburgh area. The firm will be assisted by WILLIAM L. NYBERG, district manager of Gisholt's Pittsburgh office.

BIRDSBORO CORPORATION, Birdsboro, Pa., has formed a Chemical Machinery Division which will manufacture a broad range of chemical-process equipment and special-purpose machinery. HENRY W. NORTH, president of H. W. NORTH Co., Erie, Pa., has been appointed manager of the new division, which will now make the complete line of North-Erie products previously produced and sold by the North organization.

PANGBORN CORPORATION, Hagerstown, Md., has made JOHN V. HAIDER manager of its Pittsburgh, Pa., sales district. Previously sales engi-

6 precision spindles by



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You can get this rugged Avery 250 Turret-Dex with either automatic or numerical controls. Rotary, 2- or 3-axis positioning. Pre-selected speeds, feeds, rapid advance, tapping cycles. Automatic depth control all spindles; automatic turret clamp; positive spindle stop; skip index. Capacity to $1\frac{1}{4}$ ". Eight spindles optional. Avery, Box 1264, Cincinnati 1, Ohio.

For more data, circle Item 228B on Readers' Service Card

MACHINERY, September, 1961

neer, he succeeds JOHN D. WISE, who as retired after fourteen years as Pittsburgh district manager. In addition, MELVIN R. PRICE has joined Pangborn as a sales engineer.

GISHOLT MACHINE CO., Madison, Wis., has appointed BALDWIN SUPPLY CO., Charleston, W. Va., as its representative for portions of West Virginia and Ohio. Baldwin will handle all sales of Gisholt Masterline manual and automatic turret lathes, single-spindle automatic lathes, Cri-Dan automatic threading lathes, superfinishers, and balancing machines. Sales will be directed by J. W. BOLDEN, sales manager of Baldwin Supply Co., assisted by WILLIAM L. NYBERG, district manager of Gisholt's office in Pittsburgh, Pa.

Texas

CLECO AIR TOOLS, division of REED ROLLER BIT CO., Houston, Tex., has made five changes in its sales staff, including the addition of four new personnel. WHIPPLE H. MANNING has joined the company to serve as assistant to the sales district manager in the Baton Rouge, La., office. He succeeds J. D. SENTERS, who has been named a salesman and transferred to Harvey, La., where Cleco facilities have been established. JOHN C. ROWE and IRA T. WILKINSON have been added to the firm as salesmen. Mr. Rowe has been assigned to the air-tool manufacturer's Detroit, Mich., office, while Mr. Wilkinson will work in Kansas City, Mo. FRANK J. O'NEIL has joined the company's Division 540 as a salesman and will make his headquarters in Houston.

Brazil

BENDIX CORPORATION, New York City, and BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO., Elyria, Ohio, have announced the election of GEORGE W. PHILLIPS as president of BENDIX DO BRASIL EQUIPAMENTOS PARA AUTOVEICULOS, S. A., Campinas, Brazil. Mr. Phillips, who has been vice-president and treasurer of the Brazilian company, succeeds HAROLD R. OHLHEISER, who is returning to New York for an executive assignment with Bendix Corporation's International Division.

Coming Events

SEPTEMBER 11-15—Instrument Society of America's Sixteenth Annual



NEW HYT SIZE GAGE

A DIMENSIONAL GAGE
FOR SETTING ANY
DIMENSION FROM
1/4" to 12" IN .0001" STEPS

- Embodies VK Precision
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- Speeds up dimensional set ups
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HYT SIZE GAGE
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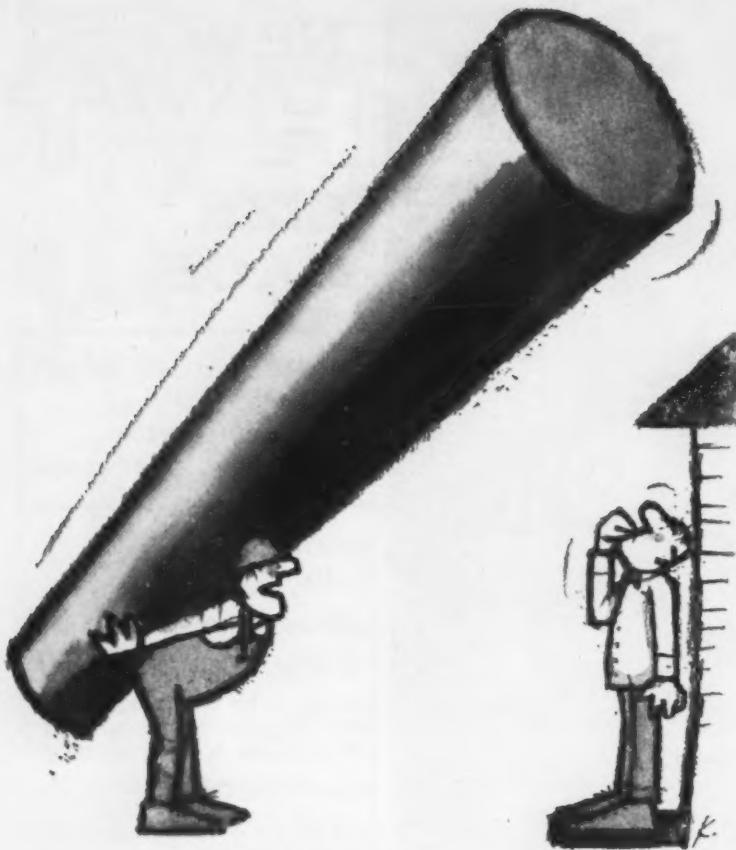
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229



FAST DELIVERY ON LARGEST ALLOY ROUNDS AND FLATS

Here's the speedy source of really big alloy steel shapes that can eliminate your storing and handling costs. Seven strategically located Wheelock, Lovejoy & Company, Inc. warehouses provide prompt service on HY-TEN alloy rounds up to 18" diameter and flats up to 16" thick and 24" wide. Rounds can be supplied smooth-turned $\frac{1}{16}$ " oversize. They're also available hot-rolled or forged to size in the annealed or heat-treated condition. Flats may be supplied forged, normalized, and heat-treated. For complete, fast, satisfactory service, call the W-L branch warehouse nearest you.

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Chicago • Hillside, N. J. • Detroit • Buffalo • Cincinnati

AGENTS—Southern Engineering Company, Charlotte, N. C.;
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"The Alloy Steel Center"

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LOVEJOY
& COMPANY, INC.**
138 Sidney St., Cambridge 39, Mass.



Instrument-Automation Conference and Exhibit, to be held, respectively, in the Biltmore Hotel and the Memorial Sports Arena, Los Angeles, Calif. For additional data, contact Ralph Stotsenburg, director, promotional services, Instrument Society of America, Penn Sheraton Hotel, 530 William Penn Place, Pittsburgh 19, Pa.

SEPTEMBER 18-20—Standards Engineers Society Tenth Annual Meeting, to be held at the Hotel Sherman, Chicago, Ill. For more information: J. E. Stevens (chairman), Chicago Bridge & Iron Co., 1305 W. 105th St., Chicago 43, Ill.

SEPTEMBER 25-28—National Fall Meeting of the American Welding Society, to be held at the Hotel Adolphus, Dallas, Tex. For further detail, contact Arthur L. Phillips, American Welding Society, 33 W. 39th St., New York 18, N. Y.

SEPTEMBER 28-29—Fourth Annual National Conference and Technical Exhibit of the American Production and Inventory Control Society, to be held at the Pick-Congress Hotel, Chicago, Ill. For more details, contact American Production and Inventory Control Society, 330 S. Wells St., Chicago 6, Ill.

OCTOBER 23-27—1961 Detroit Metal Show and ASM Materials Comparison Center, to be held in Cobo Hall, Detroit, Mich. For additional detail, contact William J. Hilty, exposition manager, American Society for Metals, Metals Park (Novelty), Ohio.

OCTOBER 23-27—Forty-Third National Metal Congress, presented by the American Society for Metals and eight participating organizations, to be held in Cobo Hall, Detroit, Mich. For more information, contact T. C. DuMond, manager, metal congresses, American Society for Metals, Metals Park (Novelty), Ohio.

New Books

MANUFACTURING PROCESSES AND MATERIALS FOR ENGINEERS. By Lawrence E. Doyle, Joe L. Morris, James L. Leach, and George F. Schrader. 777 pages; 6 by 9 inches; illustrated. Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. Price, \$15.

Looking upon today's diversified manufacturing processes as challenging engineering problems, this volume shows how they can be effec-

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MACHINERY, September, 1961

BEND? In your shop

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Bend Angles ?

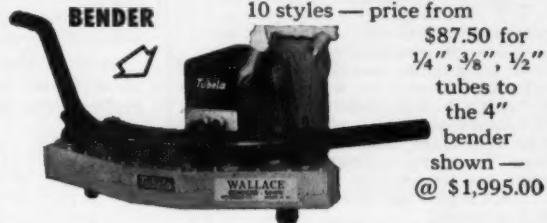
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KNOW ABOUT WALLACE BENDERS?

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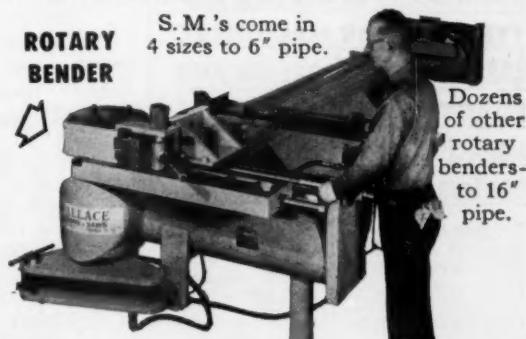


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"We use a Hardinge conical ball-mill driven by a large gear and pinion in the processing of tungsten and molybdenum concentrates. Silicious dust from the grinding was absorbed by the soaplike lubricant we were using and formed a highly abrasive compound. Frequent replacements of gears and pinions were major maintenance expenditures. The change to LUBRIPLATE Lubricants was the solution to our problem . . . not a gear nor pinion replacement in four years."

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tively solved by practicing engineers through the creative application of scientific and economic principles. Reverting constantly to fundamentals in its progressive explication, the book keynotes a rigorous analysis of metallurgy and heat-treatment of metals which prepares the reader for coping with extensive field problems in that area.

Dealing with the spectacular developments in automation from the theoretical as well as practical standpoint, the book includes an incisive explanation of the principles of fixed and selectable programming, self-regulation, feedback, and numerical and analog control systems.

While treating the economics of manufacturing along with engineering mathematics and scientific methodology, this volume quotes the typical and comparative costs for all major processes. Among other useful features, it supplies a solid background of theory on the economics of metal-cutting, process planning, and machine tool design.

COMPRESSED AIR AND GAS HANDBOOK—Third Edition. 592 pages; 6 by 9 inches; 323 illustrations. Developed, edited, and printed by Editing and Publishing Board, Compressed Air and Gas Institute, 55 Public Square, Cleveland 13, Ohio. Price, \$8.

The new, expanded, and completely revised edition of Compressed Air and Gas Handbook is written by engineers, specialists from industry, as a source of air and gas information for engineers. Data is presented in curves or tables, whenever possible, to facilitate their use. Whether the subject is large-capacity centrifugal compressors for use in the chemical industry or multiple pneumatic tools, automatic feeds, and air gaging for modern manufacturing, the engineer will find an up-to-date discussion in the book.

Managers will find the sections on air economy and centralized versus multiple-unit compressed-air systems especially useful. Operators will want to refer to the articles on maintenance schedules, lubrication, starting up new compressors, and others.

Engineering students will have many occasions to refer to the handbook in courses such as machine design, construction, plant layout, and industrial engineering. The young engineer starting a career in industry will find the work especially useful as a source of ideas and as a help in orienting himself quickly to industrial practices.

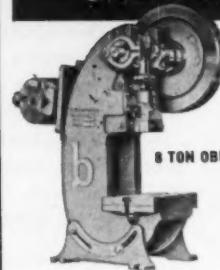
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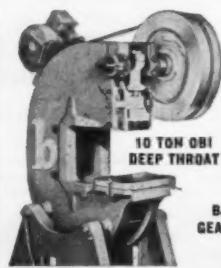
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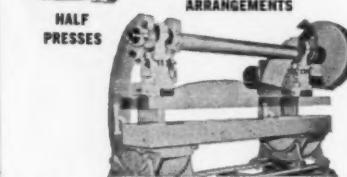
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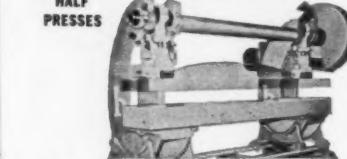
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Benchmaster gives you greater economy in first cost besides supplying the right press sizes for your job. Available in 2, 5, 8 and 10 ton capacities with selection of shut heights and stroke lengths. Wide range of types: PLAIN OBI, BACK GEARED, FIXED BED GAP FRAME, DEEP THROAT OBI, HALF PRESSES, TANDEM PRESSES!

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MACHINERY, September, 1961

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MACHINERY, September, 1961

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ZAGAR Head for
Drilling,
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the nature of the material. Tables and graphs are used as far as possible, and the text has been carefully indexed and cross-referenced.

TOOL STEEL SIMPLIFIED (revised edition). By Frank R. Palmer and George V. Luerssen. 585 pages; 6 by 9 inches; illustrated. Published by Carpenter Steel Co., 101 W. Bern St., Reading, Pa. Price, \$2.50.

This revised book, as its forerunner, is an attempt to help the alert toolmaker keep pace with the new methods, new terms, and new principles applied to this subject.

In the past few years, steelmaking practices and equipment have undergone considerable evolution; and Chapter 1, accordingly, has been revised to cover in a broad way the current recognized practices. Chapter 6, dealing with the "Matched Set Method," has been revised to reflect the growing importance of alloy tool steels. To Chapter 7, which outlines the Matched Set, have been added the so-called AISI numbers for convenient reference.

Chapter 10 has been extensively revised to include the important new

equipment and methods of control recently made available to hardening rooms, particularly those having to do with furnace atmospheres. Chapter 13, on the subject of high-speed steel, has been rewritten to fit the almost universal change-over from tungsten high-speed steels to the molybdenum types.

Two new chapters have been added, Nos. 14 and 15, the first devoted to the hot-work steels and the second to the air-hardening steels, both of these groups having increased greatly in importance. Chapter 20, dealing with furnace atmosphere, has been extensively rewritten to include the basic concepts of modern atmosphere control.

INDUSTRIAL FURNACES: Volume I, Fifth Edition. By W. Trinks and Matthew Mawhinney. 475 pages; 6 by 9 inches; illustrated. Published by John Wiley & Sons, Inc., 440 Park Ave. S., New York 16, N. Y. Price, \$17.

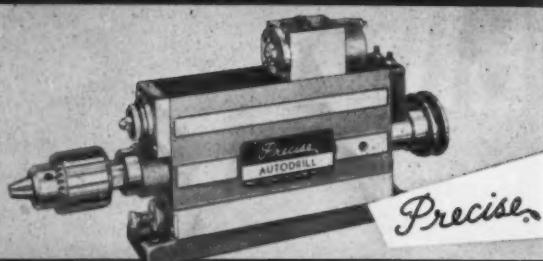
Volume I of this two-volume work lays down and discusses the basic principles underlying all furnace design and operation, with numerous graphic illustrations and typical examples to supplement the exposition.

Included in the new edition are the advances and improvements made in the field since the publication of its predecessor. Among the many changes and additions are: reorganization of the material in order to accord better with the steps taken in the actual design of a furnace; a separate chapter on the theory and calculation of heat transfer within a furnace enclosure, including radiation and convection transfer to and from the furnace gases; deletion of material on obsolete furnace designs and replacement by a discussion of more modern types of furnaces; expanded treatment of the capacity of modern forced-convection furnaces and of modern axial heating furnaces; and extensive revision of the charts to reflect new findings and new design methods.

AMERICAN STANDARD GAGING PRACTICES FOR BALL AND ROLLER BEARINGS, ASA B3.4-1960. 11 pages; 8 1/2 by 11 inches. Published by the American Standards Association Inc., 10 E. 40th St., New York 16, N. Y. Price, \$1.

This standard is one of a series being developed on the subject of ball

COMPACT . . . ONLY 2" WIDE! DRILLS 5/16" IN STEEL!



PRECISE AUTODRILL

It takes little space (just 2" wide, 12" long, 7" high) — mounts in any vertical or horizontal position on 2-inch centers — has 5/16" drilling capacity in steel! Precise Autodrill is a fully automatic drill unit with depth accuracy to .001". It's electrically operated, has air controlled advance and retract with continuously variable hydraulic infed. Maximum stroke is 1 1/2". Spindle speeds range up to 6000 rpm. Compact, modular design permits single or multiple setups — an electric and pneumatic interlock is provided for automated setups. Two compact tapping heads are available — handle up to #10, and 5/16" taps.

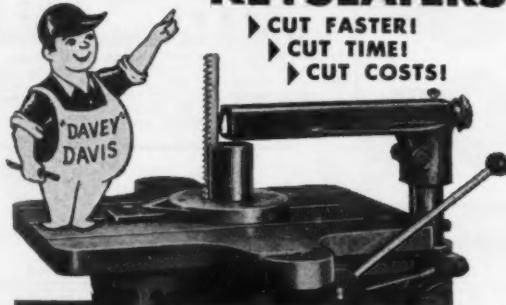
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Photo courtesy of Precise

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and roller bearings and covers gaging methods and loads. It is not applicable to tapered roller bearings and needle roller bearings. Anti-Friction Bearing Manufacturers Association, Inc., is sponsor of the standard.

AMERICAN STANDARD SPECIFICATIONS FOR MULTIPLE V-BELT DRIVES, ASA B55.1-1961. 22 pages; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, \$2.

This standard covers dimensions and recommended installation practice for V-belt drives used primarily for power transmission in industrial applications requiring one or more V-belts, and includes horsepower ratings and service factors. It does not include certain drives for automotive and agricultural applications for which other standards exist.

Electron Beam in Vacuum Anneals Refractory Sheet

A novel method of annealing is expected to have particularly broad applications in the processing of re-

active metals such as tantalum, columbium, titanium, and zirconium, as well as other metals requiring high vacuums or purified environments during annealing. It will find immediate use in the supply of metals for atomic-energy power plants and the newer rockets and missiles.

Coils of strip unwind and rewind in air at each end of the apparatus while the strip passes, continuously, into and out of a high-vacuum system. Electron-beam heating and other processing steps take place within a high-vacuum chamber. The developer of the method and equipment is Temescal Metallurgical Corporation, Berkeley, Calif.

Eventually, the system may find applications in industrial production of such sheet metals as must be economically annealed in noncontaminating atmospheres.

stainless wire, the parachutes will be used to brake space vehicles during re-entry into the earth's atmosphere.

The stainless cloth not only withstands the high heat of re-entry, but resists corrosion and contamination from residuals blown off by rocket motors. Stainless fabric parachutes can also be used in escape systems for occupants.

The fine mesh, 40,000 openings per square inch of cloth, has been employed chiefly for filters in aircraft, missile, submarine, and industrial uses. Possible future applications are: radar reflectors, antennas, auto roofs, convertible tops, seat covers, and decorative trimmings.

Linotype Spacers Useful for Gaging

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When checking small sizes, linotype spacers may be used in a manner similar to adjustable parallels for obtaining measurements as low as 0.025 inch. These spacers are hardened and precision-ground wedge-shaped parts used by printers.

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Stainless-steel parachutes appear to be the answer to one of the problems facing United States space exploration projects. Made of mesh cloth formed from finely drawn



JOHNSON MODEL J . . . A big, rugged saw that cuts anything—anywhere! 10 rounds, 18 flats, heavy structures and odd shapes. Available in wet or dry cutting models, variable speed drive and optional equipment.



JOHNSON MODEL B . . . Also available in wet or dry, metal cutting models, variable speed drive. Will easily handle 5' rounds, 10 flats, odd and irregular shapes.



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Only Johnson offers all of the outstanding construction features and performance advantages—at a lower initial price.

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Immediately available in five high capacity models to meet any metal cutting requirement—efficiently and economically.



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As a result of an agreement between the Beryllium Corporation and United Technical Industries, beryllium—the space-age metal—will be fabricated in commercial quantities from a domestic supply of ore for the first time. The agreement calls for a joint venture for the production of beryllium oxide from a proprietary

UTI process to meet the requirements of the Beryllium Corporation.

Initial operations will be in a plant in Delta, Utah, which will draw upon the large reserves of disseminated clays on UTI's properties in the southwest portion of the state. Expansion of facilities to meet existing and anticipated requirements of

the beryllium industry is included in the plans for the new enterprise. This joint venture brings to a successful climax a crash program to develop a process to effectively extract beryllium oxide from the large deposits of disseminated beryllium-bearing clays that had been discovered in January 1960. Extraction is accomplished through a proprietary chemical process recently developed and perfected.

It has been predicted that availability of this domestic supply of beryllium oxide will make possible the continuing expansion of all phases of the beryllium industry which, because of the unique properties of the metal and its alloys, serves a wide spectrum of industry from business machines to missiles and space vehicles. Significance of this development becomes apparent when it is realized that until now beryllium metal and its alloys have been produced only from beryl ore, all imported from foreign sources.

Beryl ore is a highly complex mineral from which it is difficult to extract the beryllium-oxide content because it is highly refractory. On the other hand, the domestic beryllium-bearing clays to be used by UTI are acid soluble, providing an easier and less-expensive method for extraction.

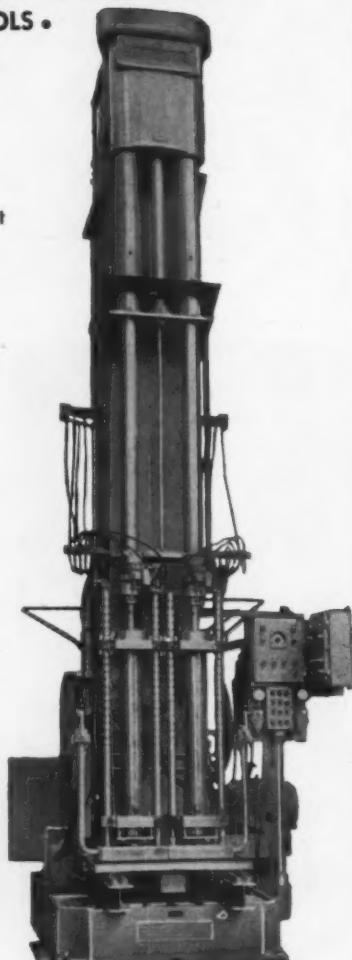
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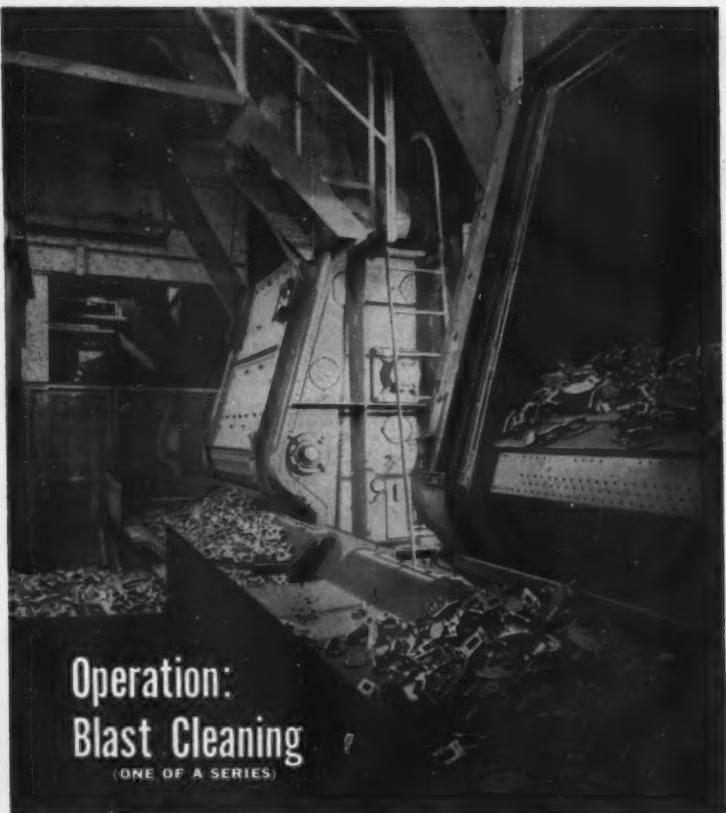
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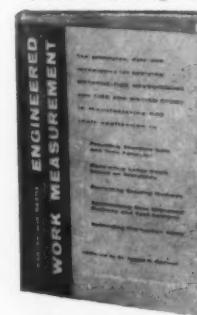
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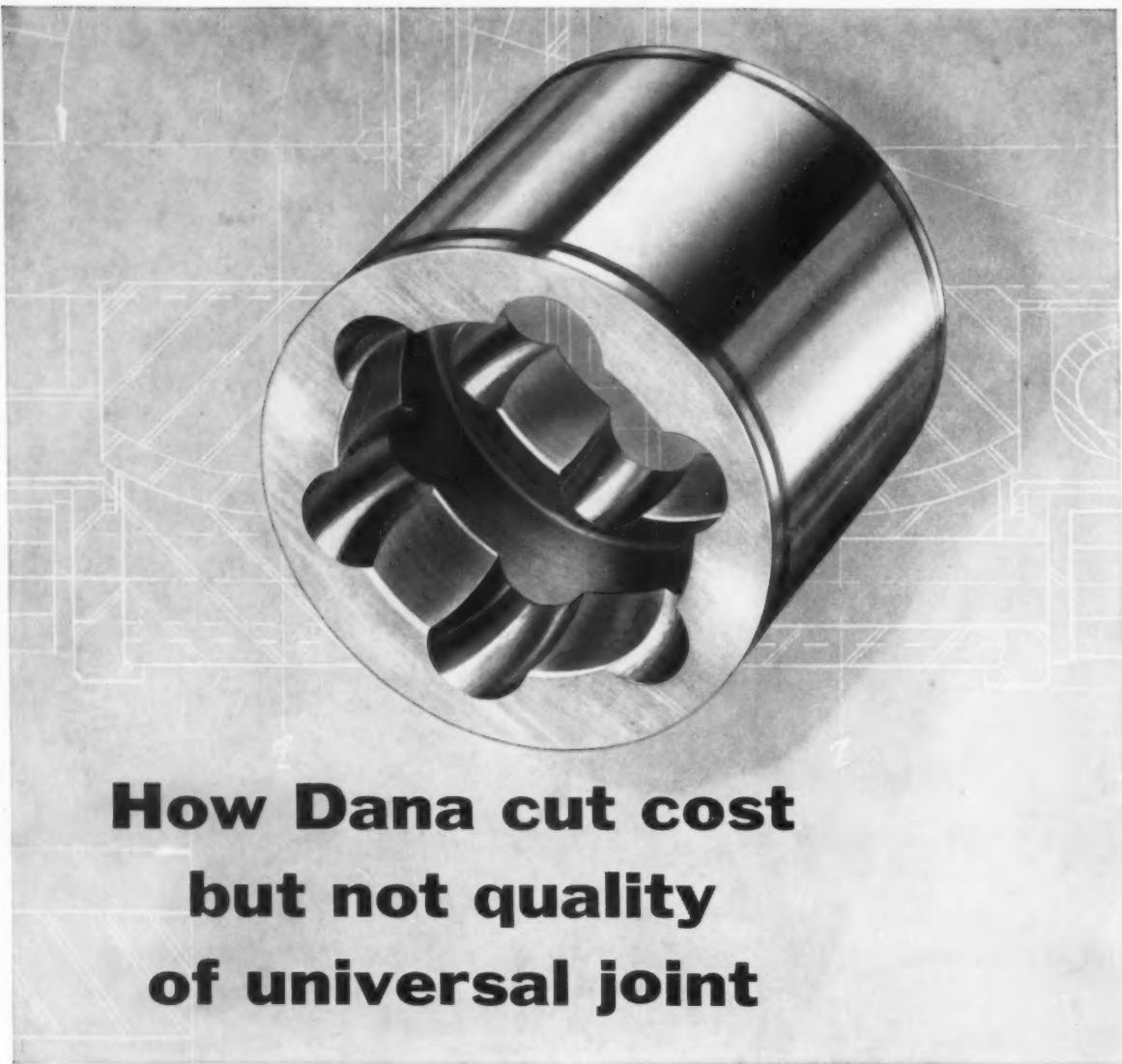
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